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CITY OF SAN BUENAVENTURA
VENTURA WATER RECLAMATION FACILITY
NPDES LIMIT ACHIEVABILITY STUDY
PHASE 3: ALTERNATE STANDARDS

Prepared for:

CITY OF SAN BUENAVENTURA
VENTURA WATER RECLAMATION FACILITY
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The City of San Buenaventura operates a publicly-owned tertiary wastewater treatment facility with a design capacity of 14 million gallons per day (MGD), and currently discharges approximately 8.5 MGD into the Santa Clara River (Estuary) and reclaims approximately 0.7 MGD for landscape irrigation use. The Los Angeles Regional Water Quality Control Board revised the Facility's National Pollution Discharge Elimination System (NPDES) permit in 1995, and included stricter discharge limits for several constituents. The Facility has been operating under interim limits for these constituents; according to the permit, the stricter limits shall apply:

> *"... after the City has conducted studies to identify the sources of pollutants, implemented all reasonable measures to reduce these pollutants in the effluent, and the limits have been determined to be achievable; otherwise site specific objectives, if warranted, may be prescribed."*

This study is the final phase in the City's evaluation of the achievability of the limits. The objectives of this study are as follows:

- Determine whether the Estuary is a freshwater or saltwater ecosystem for purposes of applying the hardness criterion (California Toxics Rule) for the metals limits;
- Review human health exposure routes and their applicability to this water body for the organic limits;
- Determine any detectable effect of these constituents on the biota of the Estuary;
- Confirm continuing benefits of the discharge.

Several tasks were completed to achieve these objectives. A review of existing data, on-going studies, and interviews with regional experts established a baseline understanding of the ecology and ambient water quality conditions for the Estuary. A bioassessment was conducted during winter, spring, and summer 1999 in order to evaluate the continued utilization of the beneficial uses and water quality, to determine whether the ecosystem is fresh water or salt water, and to detect any adverse consequences of the discharge. An evaluation of the human health exposure pathways with respect to assumptions inherent in the water quality objectives and their applicability to the Estuary was also conducted. Based upon these data, the permit limits were recalculated to account for the hardness of the water. A bioaccumulation study has been initiated to document bioaccumulation levels of four metals in freshwater shellfish, with the results available early in 2000. Finally, although this study does not recommend site-specific objectives, the criteria set forth in the Enclosed Bays and Estuaries Plan to evaluate site-specific objectives are also addressed for these proposed limits.

The principal findings of this study are as follows:

1. Most of the designated beneficial uses are supported and enhanced by the Facility's discharge. In addition, the discharge provides make-up flow for upstream water diversion and pumping, thus providing additional habitat for a number of threatened and endangered species of bird and fish.

2. The Estuary is primarily a freshwater ecosystem, which allows consideration of water hardness in recalculating NPDES discharge limits for metals. Accordingly, the methods described in the California Toxics Rule, 40 CFR 131.38 (b) and (c) can be used to calculate hardness-based water quality objectives.

3. The Estuary is a Natural Preserve and it is within the ESU for Southern Steelhead. As such, state regulations prohibit fishing and shellfish collection in the Estuary. Additionally, ENTRIX's bioassessment surveys and ongoing FWS surveys show that low numbers of suitably sized gamefish and edible shellfish inhabit the Estuary. Therefore, human consumption of the seafood in the Estuary is much lower than assumed in standard risk models. We propose that it is appropriate to consider site-specific data in calculating water quality objectives for the two organic constituents. Existing regulations and the lack of game species suggest that a consumption rate of zero would be appropriate. This report recommends that the use of a consumption rate equal to half the EPA value would still be conservatively protective of the COMM beneficial use. Adjusting the permit limits by incorporating site-specific information will be protective of the beneficial uses of the Estuary.

4. The criteria for determining the site specific objectives are met by these proposed standards.

The NPDES permit limits, interim limits, and the limits proposed on the basis of this study are as follows:

Constituent	NPDES Discharge Limit (µg/L)	NPDES Interim Limit (µg/L)	Proposed NPDES Discharge Limit (µg/L)
Copper	2.9	98	29
Nickel	8.3	271	168
Lead	8.5	77	11
Zinc	86	1,181	381
Bis(2-ethylhexyl)phthalate	5.9	-	12
Dichlorobromomethane	22	70	92

The Facility's discharge has continually met these proposed limits since January, 1997.

The City of San Buenaventura (City) operates the Ventura Water Reclamation Facility (Facility), a publicly-owned tertiary wastewater treatment facility with a design capacity of 14 million gallons per day (MGD). The Facility is located on the north bank of the Santa Clara River in the city of San Buenaventura (Figures 1-1 and 1-2) and currently discharges approximately 8.5 MGD of treated municipal wastewater into the Santa Clara River Estuary (Estuary) and reclaims approximately 0.7 MGD for landscape irrigation use. The Estuary and its surrounding marshes and riparian areas constitute the 160 acre Santa Clara River Estuary Natural Reserve. McGrath State Beach and campground are located on the south bank of the river and Estuary.

The Pacific Ocean is approximately 2,000 feet from the point of discharge. The mouth of the Santa Clara River is frequently closed off by a sand bar, creating a shallow lagoon. The lagoon discharges directly into the Pacific Ocean when the sand bar is breached. When the sand bar is intact, water in the Estuary floods the lagoon and mud flats, inundating the adjacent marsh and low-lying vegetation. During these periods, water depth in the Estuary can be several feet. The sand bar is breached naturally during winter storms or when water pressure from rising water levels in the lagoon forces a breach. When the sand bar is breached, the Estuary is subject to tidal influence.

The natural hydrology of the Estuary is typical of coastal rivers in Southern California, with low dry-season flow and large storm-driven peak flows that dissipate rapidly. This natural hydrology has been altered by upstream diversions, irrigation, and the consistent freshwater from the facility. The facility's discharge makes up in part for upstream diversion and provides critical wildlife and fish habitat.

The Estuary is home to a wide variety of wildlife including two species of federally listed endangered fish, the tidewater goby and the Southern California Steelhead. The Estuary also provides a valuable Southern California bird habitat for migratory and resident birds. State and federally listed threatened Snowy Plovers are common visitors and federally and state listed endangered least-terns historically establish nesting colonies near the Estuary. Vegetation units in the Estuary include riparian forest, mud flat, marsh and sand dune. A rich community of estuarine and fresh water fish, invertebrates, amphibians, and reptiles are supported by the habitat in the Estuary.

Figure 1-3 provides a map of the Estuary, the Facility, the State Parks Campground and the Pacific Ocean.

This report is organized as follows:

Section 1.1 provides the regulatory background to this study.

Section 1.2 describes the objectives of this study, and the approach followed in meeting these objectives.

Section 2.0 describes the methods used in this study.

Section 3.0 presents the results of the bioassessment, including the context provided by other studies ongoing in and near the Estuary.

Section 4.0 uses the results presented in Section 3 to address the objectives of the study, and proposes revised permit limits based upon the study findings. Although the additional step of identifying these revised limits as site specific objectives does not appear to be necessary, the criteria for establishing such objectives are evaluated for the proposed permit limits.

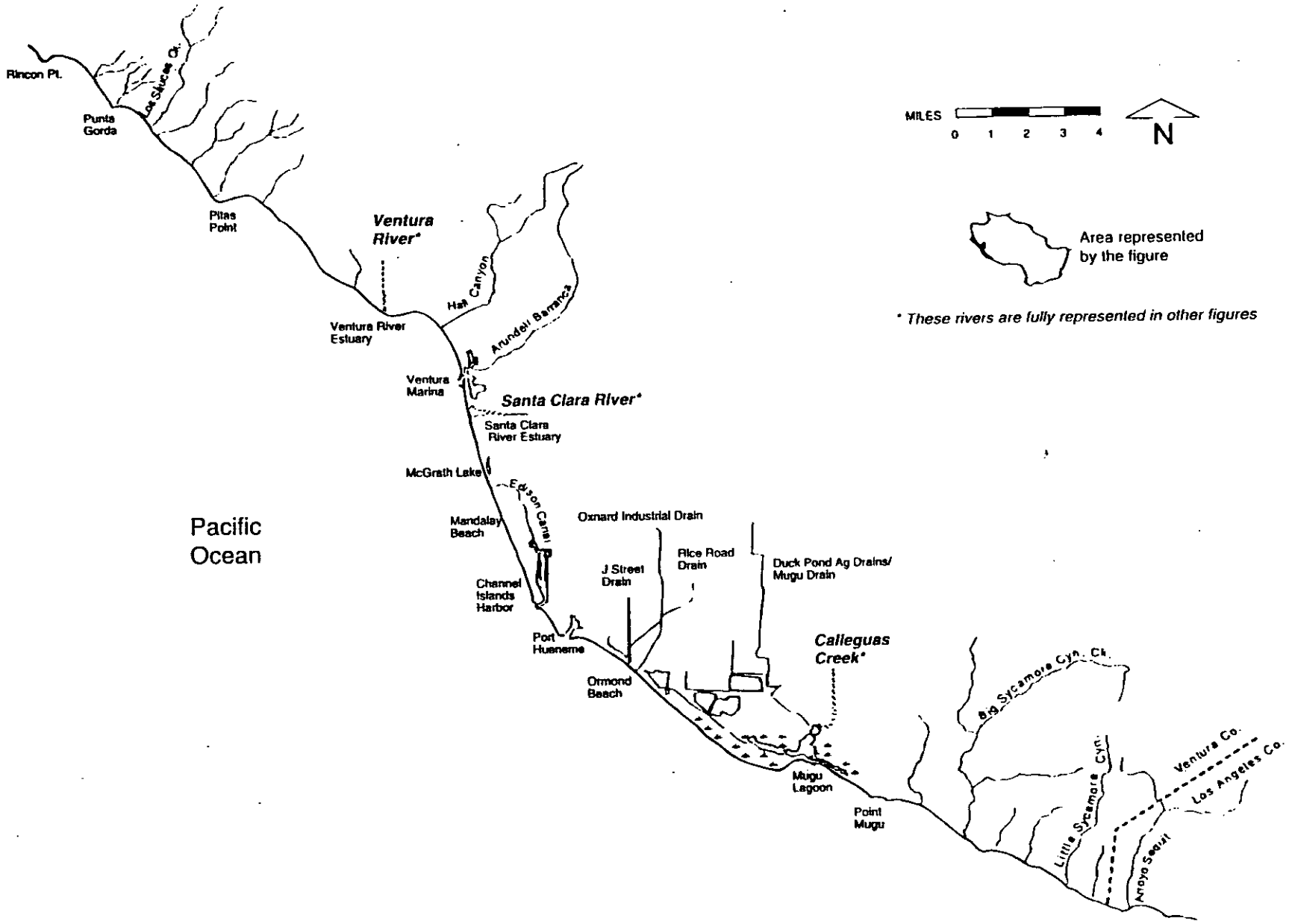


Figure 1-1. Miscellaneous Streams and Coastal Features - Ventura County, California

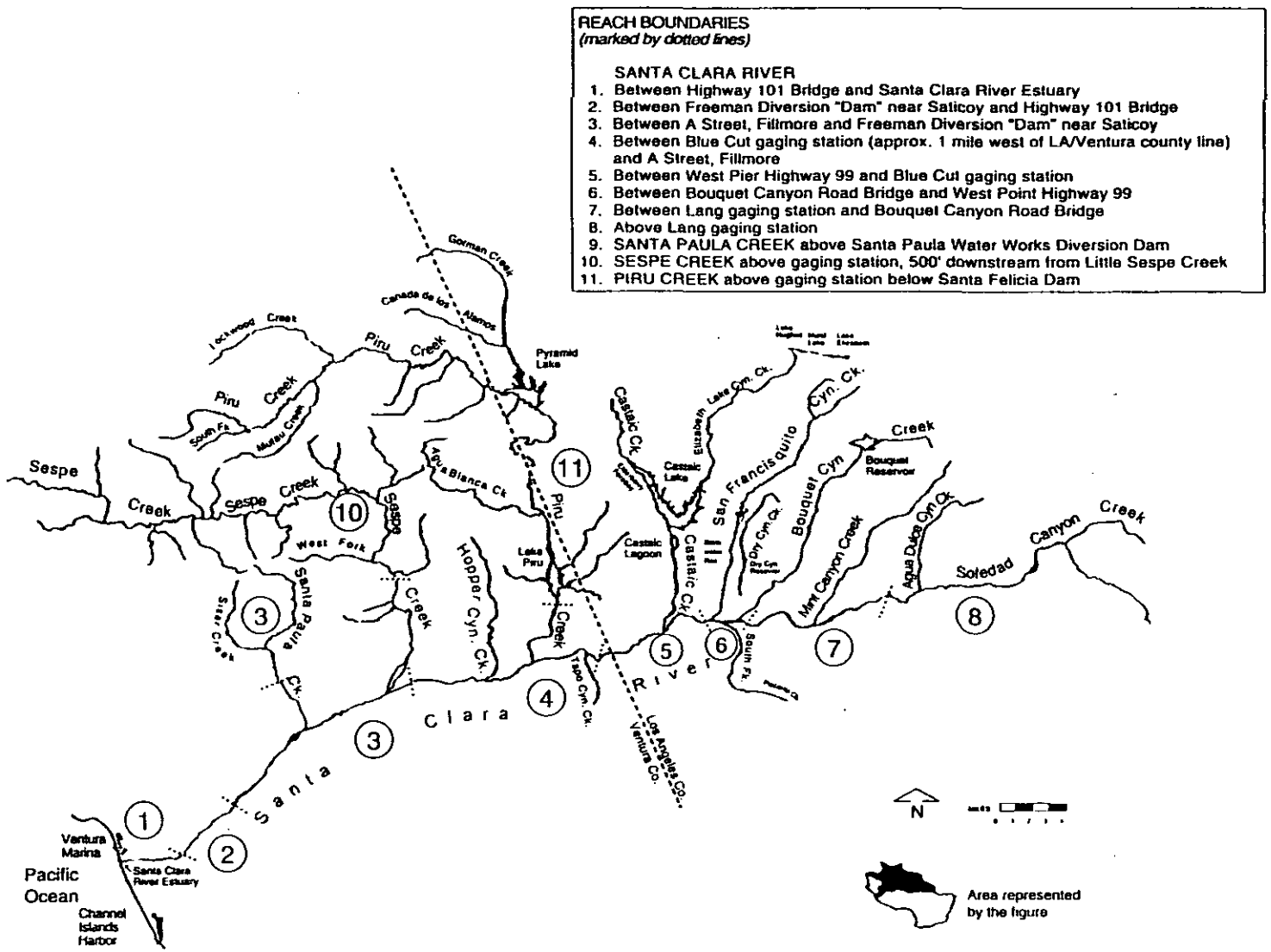


Figure 1-2. Major Surface Waters of the Santa River Watershed

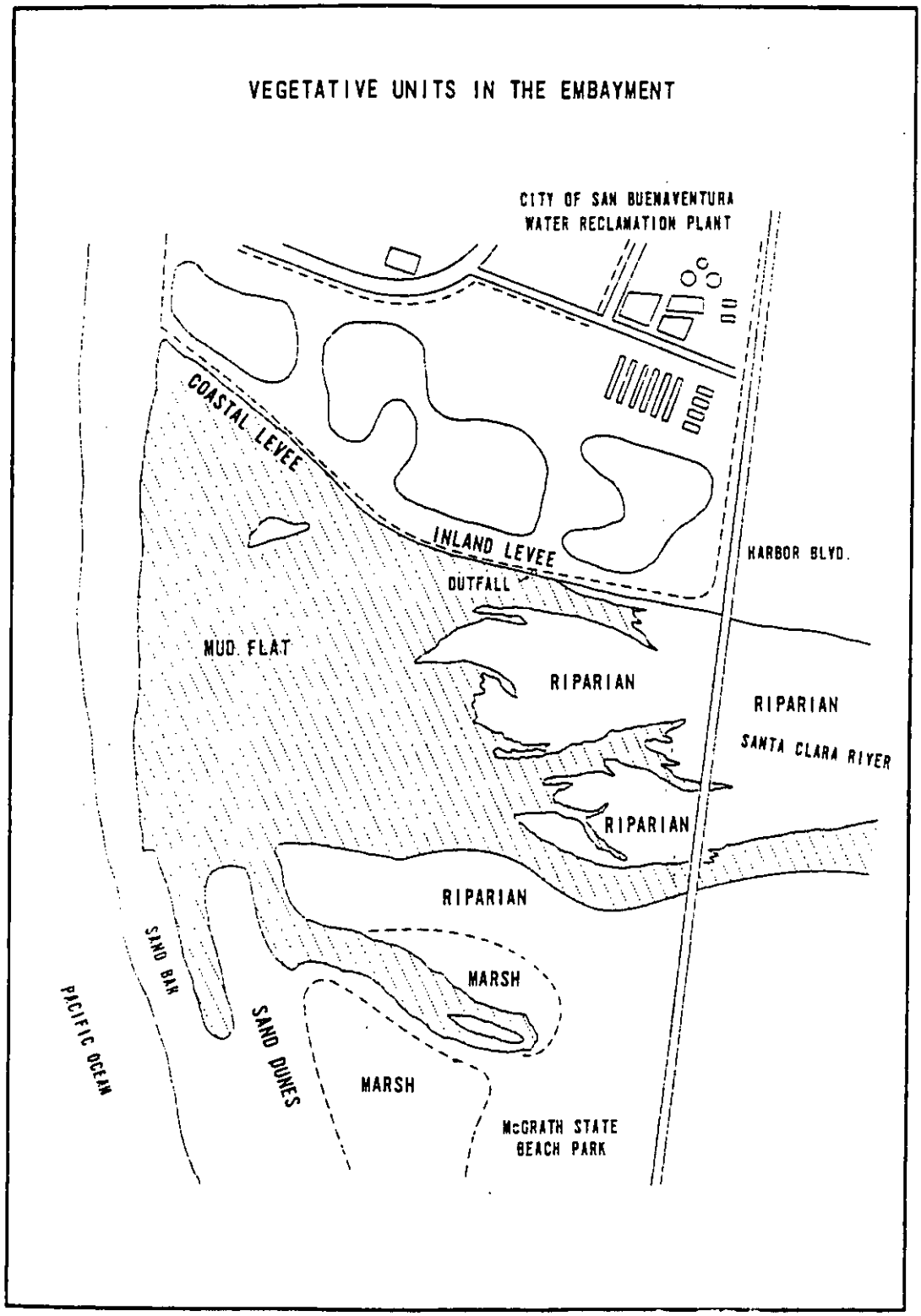


Figure 1-3. **Study Area and 1976 Vegetative Units in the Estuary** (Ref: Engineering-Science, Inc.)

1.1 REGULATORY BACKGROUND

In June, 1995, the Los Angeles Regional Water Quality Control Board (Regional Board) issued a revised National Pollution Discharge Elimination System (NPDES) permit for the City's Facility. Among the changes included in the permit were new or more restrictive limitations for many chemicals of concerns (COCs). These new limits were based on water quality objectives outlined in the *California Enclosed Bays and Estuaries Plan* (April, 1991), and are generally consistent with the California Toxics Rule (USEPA, 1997). These limits were set at conservative levels to protect aquatic life and human health in the receiving waters of the Estuary. According to the permit (section II.A.3), the primary effluent limitations are to apply:

> *"... after the City has conducted studies to identify the sources of pollutants, implemented all reasonable measures to reduce these pollutants in the effluent, and the limits have been determined to be achievable; otherwise site specific objectives, if warranted, may be prescribed."*

Interim limits were set at the 95 percent confidence interval of the Facility's then-existing (January, 1990 – October, 1994) effluent concentrations (Table 1-1) while the studies specified in the permit were conducted.

Table 1-1. Interim Discharge Limits for Six Constituents of Concern

Constituent	NPDES Discharge Limit (µg/L)	NPDES Interim Limit (µg/L)	Drinking Water Standard (µg/L)
Copper	2.9	98	1,300
Nickel	8.3	271	100
Lead	8.5	77	15
Zinc	86	1,181	2,000
Bis(2-ethylhexyl)phthalate	5.9	-	6
Dichlorobromomethane	22	70	60

In May, 1996, the City completed the first phase of these studies. In the Phase 1 report (*NPDES Limit Achievability Study, Phase 1 Achievability of Permit Limits Through Source Control Measures*), the City showed that existing treatment processes at the Facility provided compliance for the majority of COCs in the effluent. Compliance for six COCs (zinc, copper, lead, nickel, bis(2-ethylhexyl)-phthalate and dichlorobromomethane), however, was not currently being met with existing facility controls.

The City also identified the potential sources of each of these COCs, and where possible, recommended alternative processes for removing or reducing the levels in the effluent. The source of zinc in the wastewater was identified as zinc orthoposhphate, a corrosion control additive in the water supply. Alternative corrosion control additives were used, resulting in compliance for zinc. Compliance for copper, lead, nickel, and bis(2-ethylhexyl)phthalate could not be met with discharge limitations imposed on controllable sources, because the sources of these COCs are either uncontrollable or unknown. Although the facility's removal efficiency of these materials is relatively high, it does not produce effluent that can reliably meet the NPDES permit limits. Similarly, the study found that compliance for dichlorobromomethane could not be met with discharge limitations or process modifications. The source of this COC was identified as material generated in the conventional disinfection process utilizing chlorination. There are no reasonable alternative disinfection processes that comply with California Department of Health Services guidelines.

In February, 1998, the City concluded the second phase of the studies outlined in the permit. The results are reported in *NPDES Limit Achievability Study. Phase 2 Achievability of Permit Limits Through Treatment Process Modifications*. The City evaluated whether the current treatment methods could be modified to improve the removal efficiency for the six COCs. The City also investigated all reasonable alternatives to: (1) corrosion control, (2) disinfection processes, and (3) removal methods. The report found that:

- There are no wastewater treatment technologies that have a demonstrated ability to consistently achieve the necessary removal efficiency for copper, lead, nickel or bis(2-ethylhexyl)-phthalate. The processes now operating in the Facility have removal performances for these COCs consistent with similar treatment processes documented in the literature.

- Substitution of an alternative disinfection technology for chlorination, to reduce the formation of dichlorobromomethane, involves significant uncertainties in the ability to meet the permit limit.

1.2 STUDY OBJECTIVES AND APPROACH

This study is the third and final phase in the City's evaluation of the achievability of the limits. The following paragraphs describe the approach in greater detail. The objectives are as follows:

- Determine whether the Estuary is a freshwater or saltwater ecosystem for purposes of applying the hardness criterion (California Toxics Rule) for the metals limits;

- Review human health exposure routes and their applicability to this water body for the organic compounds;

- Determine any detectable effect of these constituents on the biota of the Embayment;

- Confirm continuing benefits of the discharge.

The study approach is to integrate the results of a biological assessment with water quality data and other existing or ongoing studies to address these objectives. The following paragraphs describe the approach in greater detail.

The Estuary is a water body that is not naturally perennial but supports aquatic habitat beneficial uses during the dry season as a result of the discharge of reclaimed water. As such, the Estuary meets the definition of a *Category a* waterbody as defined in the California Enclosed Bays and Estuaries Plan (CEBEP; SWRCB, 1991). The Water Quality Control Plan (Basin Plan) for the Los Angeles Region (RWQCB, 1994) recognizes a number of beneficial uses for the receiving waters of the Estuary, including:

- Navigation
- Water Contact Recreation
- Non-Contact Water Recreation
- Commercial and Sport Fishing
- Estuarine Habitat
- Marine Habitat
- Wildlife Habitat
- Rare, Threatened or Endangered Species
- Migration of Aquatic Organisms
- Spawning, Reproduction and/or Early Development of Fish

In the revised permit, the Regional Board:

> *"...concurred with the findings in the [1978] facilities plan that [the facility's] discharge is not degrading the beneficial uses of the Estuary, and in fact, some of the beneficial uses, such as fish and wildlife habitat and non-contact water recreation, are enhanced by the presence of the discharge."*

The California Toxics Rule (CTR; USEPA, 1997), the Basin Plan and the CEBEP outline procedures for recalculating water quality objectives based on site-specific information. The Basin Plan and the CEBEP outline a series of steps to evaluate whether such a recalculation is prudent and protective of the beneficial uses identified for the water body. In the previous Phase 1 and Phase 2 studies discussed above, the City addressed these preliminary steps. In these previous studies the City:

- recognized the beneficial uses of the discharge to wildlife, aquatic resources, or recreation;
- provided a thorough review of current technology and technology-based limits which can be achieved at the Facility;
- provided a thorough review of historical limits and compliance with the proposed limits at the Facility;
- conducted an economic analysis of compliance with the proposed objectives;

- conducted an analysis of compliance and consistency with all federal, state, and regional plans and policies.

The California Toxics Rule (40 CFR Part 131) sets ambient water quality criteria for priority toxic pollutants. Of relevance to the metals of concern in this Study, the rule notes that:

> *"chemical toxicity is often related to certain receiving water characteristics (pH, hardness, etc.) of a water body. Adoption of some criteria without consideration of these parameters could result in the criteria being overprotective"* (40 CFR 131, E).

If a bioassessment of the Estuary indicates a predominantly fresh water ecosystem, then the hardness of the receiving water can be used to derive a site-specific objective for the metals. Hardness is used as a surrogate for a number of water quality characteristics that affect the toxicity of metals in a variety of ways. Increasing hardness has the effect of decreasing the toxicity of metals (40 CFR 131 E.2.g). Accordingly, hardness-dependent equations for fresh water metals criteria presented in the California Toxics Rule will be used to establish site-specific objectives.

For the organic COCs, there is little toxicity data on ecological receptors. The NPDES permit limits have been set using human-health based criteria, as was the California Toxics Rule. This study evaluates the exposure pathways indicated by the beneficial uses, and relates those exposure parameters to those used to establish the permit conditions. The study evaluates the suitability of considering site-specific parameters to establish objectives.

The Basin Plan and the CEBEP provide a series of steps for determining site-specific water quality objectives (SSOs). Although we are not proposing SSO's, our approach in this study is to utilize site-specific data to allow the calculation of limits that are more appropriate to site conditions. The CTR provides an approach for performing such site-specific calculations. Based on these adjustments, the NPDES permit should not require the development of site-specific water quality objectives.

The steps and criteria outlined in the Basin Plan and CEBEP for determining SSOs, however, do provide a conservative approach for ensuring the protection of the beneficial uses of the Estuary. As such, they provide useful guidance to assist in the evaluation of potential adverse consequences of discharge. In this study, we evaluate these criteria for completeness.

In addition to these specific assurances outlined by the Basin Plan, this study assesses the degree to which the discharge supports or enhances the beneficial uses in the Estuary. This demonstration is provided by the bioassessment, supplemented by information obtained from other studies conducted in the Estuary. The regional significance of the ecosystem supported by the discharge is addressed by qualitative comparison to the other

category (a) waterbodies in the region (Ventura River, Calleguas Creek, Malibu Creek) as well as smaller coastal streams.

This study does not examine any additional priority pollutants, metals, bacteria/viruses or physical characteristics of the City's effluent, as these parameters are currently within the NPDES discharge limits. Potential hydrological impacts of the City's discharge are similarly beyond the scope of this study.

This study integrates existing information and knowledge of the biological resources of the Estuary with new work. The methods used in this study include the following:

1) A review of existing data and on-going studies to establish a baseline understanding of the ecology and ambient water quality conditions for the Estuary;

2) Interviews with regional experts to document the level of use of the specified beneficial uses of the Estuary;

3) Bioassessment studies to confirm the continued utilization of the beneficial uses and water quality, to determine whether the ecosystem is fresh water or salt water, and to detect any adverse consequences of the discharge;

4) An evaluation of the human health exposure pathways with respect to assumptions inherent in the water quality objectives and their applicability to the Estuary;

5) Recalculation of permit limits based upon the site-specific information;

6) A bioaccumulation study to document bioaccumulation levels of the metals COCs in freshwater shellfish.

The workplan was circulated to the following agencies for review and comment:

- US EPA
- USFWS
- NMFS
- DFG
- California Coastal Commission
- California Coastal Conservancy
- California Department of Parks and Recreation (Channel Coast District)

The California Coastal Conservancy, USFWS, and California Department of Parks and Recreation offered verbal comments on the workplan. The nature of the comments were such that no substantive change to the original plan was required. The other agencies were contacted to assure that they received the Workplan, and that the proper staff person had a copy. No other comments were received, however. The following sub-sections describe the study methods in greater detail.

2.1 EVALUATION OF EXISTING DATA

2.1.1 EIR AND ANNUAL REPORTS

An environmental impact report prepared in 1976, prior to a planned enlargement of the Facility (E-S, 1976), provides a baseline for the terrestrial and aquatic ecology of the Estuary in 1976.

In compliance with the Facility's NPDES permit requirements, the City prepares annual monitoring reports on the quality of the Facilty's discharge, including concentrations of priority pollutants and toxicity test results. In addition to the reported monitoring results, the City monitors ambient water quality at selected stations in and just upstream of the Estuary.

2.1.2 VENTURA PORT DISTRICT DATA

In 1998, the Ventura Port District conducted a study of contaminant levels, salinity and water hardness in the nearby Ventura Harbor, Santa Clara River and barrancas that discharge to the river (unpublished data of Merritt-Smith, 1999). A portion of this study measured ambient concentrations of metals and organic compounds at the rivermouth (Estuary) and at the Victoria Street Bridge, approximately one mile upstream from the Estuary. Hydrograph meters measured hourly salinity levels in the Estuary in August, September, October, December 1998 and January 1999. Measurement collection ran for 2-3 days and ranged from 38-67 hours. Salinity measurements were collected just north of the Harbor Boulevard Bridge and at the mouth of the Estuary on the south side of the river. Although the focus of this study was not the Estuary, the resulting data provide some background information on ambient water quality conditions in the river in 1998/99.

2.1.3 STATE PARKS DATA

In 1989 the Department of Parks and Recreation (DPR) commissioned a study to recommend a management plan for the protection and enhancement of the Estuary (Swanson, et al., 1990). The existing conditions portion of the report presents the results of vegetation, water quality, soil salinity, invertebrate and fish surveys conducted in August and November 1989. This study updates the 1976 EIR with a description of vegetation and species composition in the Reserve.

Since the summer of 1997 the US Fish and Wildlife Service (USFWS) and DPR have conducted a long-term study of the aquatic ecology of the Estuary. The survey design includes bi-monthly surveys of water quality and aquatic biology, employing beach seines, minnow traps and benthic samples at stations throughout the Estuary. Although the study results will not be available until late-Fall 1999, interviews with the principal investigator at USFWS contribute some preliminary conclusions to this study.

2.1.4 EXPERT INTERVIEWS

This study includes interviews with local authorities in terrestrial vegetation, avifauna, ichthyology, benthic infaunal communities and natural reserve resources. These experts identified sensitive species living within the Estuary as well as described the natural history and distribution of the terrestrial vegetation, migratory and resident bird populations, and fish and benthic community. This report summarizes their professional judgements on the health of the Estuary and the potential impact of a loss of fresh water input from the Facility.

Interviews with State Park's biologists reviewed the regulations in the natural reserve, which includes the Estuary, and Park operations and maintenance policies.

2.2 BIOASSESSMENT AND WATER QUALITY SURVEY OVERVIEW

In 1999 ENTRIX conducted a series of biological surveys on the terrestrial vegetation, terrestrial wildlife, avian and aquatic biological communities and water quality. The surveys were designed to characterize seasonal differences in the water quality and ecological communities of the Estuary.

Vegetation and aquatic surveys were conducted in winter (wet season, river flow, sandbar open), spring (some river flow, sandbar closed for an extended period) and summer (dry season, minimal river flow, sandbar recently closed). Sampling in the three seasons allowed us to capture variation due to tidal and river influence, rain fall, Estuary inundation and predation. Sampling at different seasons also facilitated the observation and identification of annual and late-flowering vegetation species. Water quality samples were collected during the aquatic surveys at the same sampling locations. Two avian surveys were performed to characterize the migrant (winter) and breeding (spring) species. As most wildlife in the Estuary are resident, wildlife surveys coincided with the avian surveys.

Survey dates and times and tidal conditions are presented in Table 2-1. All surveys were conducted during pre-dawn and daylight hours.

Table 2-1. Bioassessment Survey Dates and Predicted Tides Survey Days During March, June and September, 1999.

DATE	DAY	HIGH HEIGHT (TIME)	LOW HEIGHT (TIME)	HIGH HEIGHT (TIME)	LOW HEIGHT (TIME)	SANDBAR STATE
March 09	Tuesday	4.1 ft msl (0142)	1.2 ft msl (0941)	2.7 ft msl (1657)	2.6 ft msl (1941)	open
March 10	Wednesday	4.1 ft msl (0252)	0.9 ft msl (1102)	2.9 ft msl (1830)	2.8 ft msl (2140)	open
March 11	Thursday	4.2 ft msl (0408)	0.5 ft msl (1158)	3.2 ft msl (1902	2.6 ft msl (2307)	open
March 12	Friday	4.5 ft msl (0511)	0.1 ft msl (1239)	3.5 ft msl (1924)	-	open
March 16	Tuesday	5.7 ft msl (0809)	-0.7 ft msl (1451)	4.8 ft msl (2059)	-	open
March 17	Wednesday	5.7 ft msl (0851)	-0.6 ft msl (1524)	5.1 ft msl (2129)	-	open
June 03	Thursday	----	-0.2 ft msl (0729)	3.4 ft msl (1438)	2.8 ft msl (1823)	closed
June 17	Thursday	5.8 ft msl (1215)	-0.9 ft msl (0739)	4.0 ft msl (1436)	2.5 ft msl (1921)	closed
June 18	Friday	5.2 ft msl (0111)	-0.5 ft msl (0833)	4.2 ft msl (1539)	2.5 ft msl (2044)	closed
June 24	Thursday	3.3 ft msl (0830)	0.5 ft msl (0226)	5.4 ft msl (1954)	1.8 ft msl (1323)	closed
Sept. 20	Monday	4.0 ft msl (0809)	0.6 ft msl (1326)	5.0 ft msl (1901)	2.6 ft msl (1306)	newly closed
Sept. 21	Tuesday	4.2 ft msl (0833)	0.3 ft msl (1402)	5.3 ft msl (1943)	2.2 ft msl (1345)	closed

2.3 VEGETATION SURVEYS

Vegetation observations were recorded through vegetation maps, species lists, and a limited quantitative sampling program. Polygons for mapping were determined based on visually determined species dominance and categories. Because of the comparative rarity of marsh vegetation and habitat, the marsh at the southwest side of the Estuary was mapped in more detail than the rest of Estuary. All species encountered were recorded.

The vegetation study included both quantitative sampling of vegetation and qualitative observations in the six vegetative units described in the initial EIR (ES 1976). Quantitative observations used line transects to record plant identity and abundance. Primary transects were located so that each lies within one of the vegetative units and were placed parallel to the water line. Secondary transects were located randomly along

the primary transect and placed perpendicular to the primary transect and the water line. Vegetation was recorded as line-intercept data along the secondary transects. Species present in a unit, but not recorded in the quantitative sampling, were noted in the species list for the project. The extent of the vegetative units were mapped.

During the Winter vegetation observations were made in the riparian areas on both the north and south sides of the Estuary. Quantitative transects were surveyed in the marsh on the south side of the Estuary, near the mouth of the river and in the mudflats. Standing water was present on the west side of the marsh, just west of the sand dunes that lie between the marsh and the ocean.

The Spring and Summer vegetation surveys were conducted in the marsh and riparian areas on the south side of the Estuary and the riparian/sand dune area to the north. Because of the high water levels, many areas surveyed in the Winter survey (notably the mudflats, portions of the marsh and much of the area along the north side of the Estuary) were inaccessible in the Spring survey. The purposes of the Spring and Summer surveys were to: 1) record the presence and extent of the dominant vegetation in each surveyed area; 2) identify species which may have been dormant or not blooming in the Winter survey; 3) continue to identify the presence and location of any endangered species or species of special concern; 4) continue to record the presence and location of any freshwater species (i.e. intolerant of brackish/saltwater). A DPR botanist assisted during the Spring survey to aid in the location and identification of sensitive species.

The taxonomy of plants is based on Hickman (1993).

2.4 AVIAN AND WILDLIFE SURVEYS

Wildlife surveys were conducted during March and June 1999 in order to characterize the wildlife resources occurring in the Estuary and surrounding habitats. Both the 1976 EIR (E-S, 1976) and the 1999 field surveys identified four main habitat types within the project boundaries. These are mudflat/open water, marsh, beach/near shore, and riparian habitats. The predominant wildlife species occurring in each of the habitat types were identified, along with the functional relationship and beneficial use of each habitat to the wildlife resources, such as foraging, breeding or roosting. Since the surveys were performed over the two seasons that receive the greatest wildlife use, particularly by birds, the information gathered during these periods will be a good indication of the variety of wildlife species inhabiting the site. Nevertheless, it is recognized that many species may only have a limited occurrence or life stage at the project site. Therefore, they may not be identified during the time of the surveys.

2.4.1 AVIAN SURVEYS

Three different quantitative sampling methods were implemented to characterize the species composition and relative abundance of the various bird groups associated with the specific habitats. Line transects were surveyed to record species in the beach and marsh habitats. Point counts of individuals, by species, were used to document the occurrence

of birds inhabiting densely vegetated riparian areas. Direct counts were used to quantify waterbird presence in open water/mudflats areas.

The riparian surveys were conducted between sunrise and the ensuing 3 to 4 hours, since bird activity and song output are usually increased during this time period compared to later in the day. The remaining surveys were conducted at various times of the day. During the line transects and point counts, birds were counted using 10x42 binoculars. Direct counts were conducting using a 20-60x spotting scope.

In addition to the quantitative surveys, qualitative observations were made on how birds are using the site. For example, information on nesting, foraging or roosting behavior was noted. Also, the presence of juveniles and observations of parental care, for example, the feeding of young, were used as an indication that species are breeding at the site.

A. Line Transects

Line transects are best suited to cover large areas that are relatively uniform in habitat distribution and vegetation composition, particularly open habitats with relatively low and sparse plant cover, such as the beach and marsh habitats. Line transects in the marsh were approximately 500m in length, with a total band width of 50m, 25m on each side. Line transects within the marsh were only conducted during the Winter survey period. During the late Spring survey, the area was flooded, which prevented access. Consequently, a direct observation survey was made from a fixed point along the levee.

The beach line transect was approximately 1000m. The beach transect was surveyed north of the river mouth.

B. Point Counts

In densely vegetated areas, access and movement of the observer is impeded and any attempt to maneuver through these areas causes disturbance to birds. Thus, to reduce disturbance in the riparian habitat, point count surveys were conducted. All point count stations were established at equidistant intervals of 50m along a transect line. The 50m intervals were established as the noise level from the nearby road made it extremely difficult to hear singing birds. Thus, species were documented within a 25m radius. In the riparian survey area, 12 point count stations were established. However, during the Spring/Summer surveys, only eight stations were surveyed due to flooded conditions.

Counts began when the observer reached the census point and continued for 10 minutes. Any bird flushed while approaching the station was recorded separately from the point counts. The type of data collected for the observed individuals was the same as those described for line transects. A list was kept for species outside the 50m limit, between point counts, flying overhead, or flushed while approaching census stations.

C. Direct Counts

Direct counts for highly visible species, such as waterbirds, were conducted from strategic locations adjacent to the open water/mudflat habitats. Surveys for the Estuary were performed during low and high tide conditions. During the Winter surveys, the river mouth was open. In contrast, during the Spring surveys, the river mouth was completely closed and water was backed up into the marsh area adjacent to the McGrath State Beach Park, located at the southern end of the Estuary. As such, the marsh area was surveyed by direct counts due to the flooded conditions. Again, the information recorded during these surveys was similar to those previously described for line transects and point counts.

2.4.2 MAMMAL SURVEYS

Visual surveys were conducted in sand dune, riparian, and marsh habitats to identify small mammal species that inhabit the project area. Small mammal species included mice, rats, squirrels, pocket gophers, shrews, moles, and bats. Direct observations of the individuals themselves, as well as evidence such as scats, skulls, tracks, burrows, and bodily remains, were used to document the presence of this group of animals.

Medium and large mammals, such as hares, opossums, raccoons, skunks, foxes, coyotes and deer, are typically mobile and may spend time in several habitats. As a result, observations were made to identify small, medium and large mammals of the project site without the restriction of specific sample areas. In areas representative of the major habitat types, qualitative reconnaissance level surveys were conducted during daylight hours. During the daytime surveys, records were made of all mammals observed, including live individuals, scat, tracks, skulls and other bodily remains, and burrows and dens.

2.4.3 REPTILE AND AMPHIBIAN SURVEYS

Loose boards, logs, and other debris were turned over and dense vegetation was examined in an attempt to find hiding individuals. Standing pools of water were surveyed for amphibian eggs and tadpoles, as well as adults. Observations of all amphibians and reptiles were recorded. Also, qualitative descriptions were made of the nearby vegetation and associated habitat.

2.5 AQUATIC AND WATER QUALITY SURVEYS

Fish seine, benthic cores and water quality data were collected at four sites in the Estuary in Winter, Spring and Summer 1999 (Figure 2-1). Depending on water depth, either a 50-foot beach seine or a 15-foot beach seine was used to sample the fish and invertebrates in the water column along the shore. Both seines have $1/8^{th}$ inch mesh. All seined organisms were identified to the lowest possible level and released. Where necessary, voucher specimens were collected for further identification.

Benthic core samples (approximately 12-14 cm deep) were sieved on site using a 0.5 mm mesh screen and preserved in sample jars for later sorting and taxonomic identification. During the Spring survey, water depths required the use of an Eckman grab sampler rather than the core sampler. Sampling depth of both methods is approximately equal although the Eckman samples a larger surface area. The focus of this study is species presence and relative abundance. Adjustments for equipment surface area would be required prior to numeric analyses.

Water quality samples were collected mid-depth in sample jars for laboratory analysis of hardness and salinity. Salinity, pH, conductivity, turbidity, DO and temperature were also collected *in situ* using a Horiba water quality sampler. When depth was sufficient, surface, mid-depth and bottom measurements were recorded at the station locations, descriptions and seine samples are presented in Table 2-2. Figure 2-1 provides a map of the approximate aquatic sampling station locations. As much as possible, aquatic sampling stations were located in the same place for each survey.

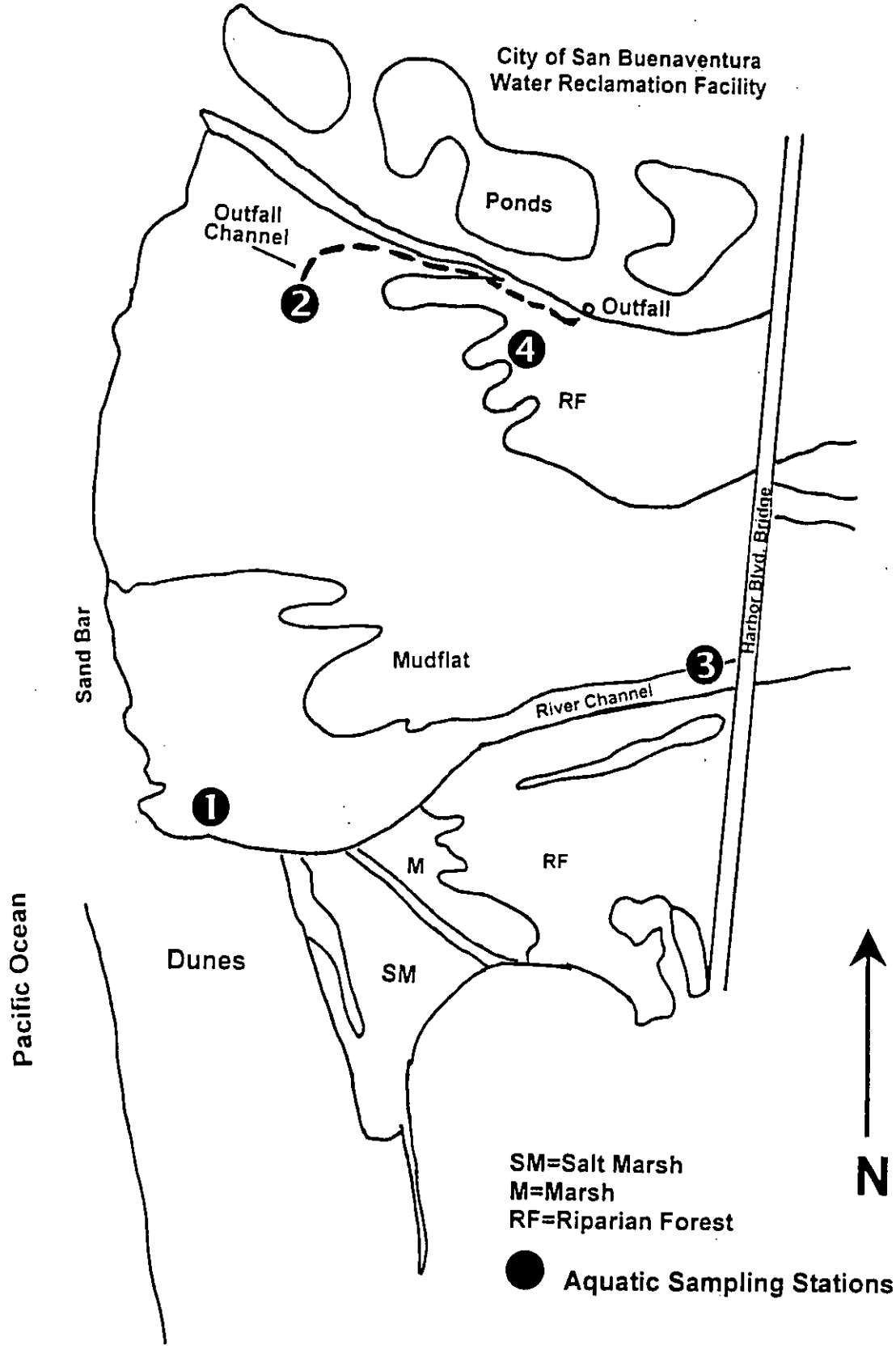


Figure 2-1. Aquatic Sampling Station Locations of the Santa Clara River Estuary

Table 2-2. Aquatic and Water Quality Sampling Station Descriptions.

STATION #	DATE/TIME	LOCATION	DESCRIPTION	DEPTH
1	Mar 16/10:10 (seine & wq) /Mar 16/18:10 (benthic)	Mouth	South side of estuary, adjacent to sand dunes, near estuary mouth; 50 ft bag seine; 2 replicate pulls approx. 45 ft in length. No aquatic vegetation. Three water column wq measurements. Benthic core collected at low tide (exposed mudflat).	2 ft.
2	Mar 16/14:12 (benthic) /Mar 17/9:25 (seine & wq)	Outfall	Outfall channel approximately 50 feet from confluence with north-side of the river channel; 15 ft bag seine; 3 replicate pulls approx 30 ft in length. Tules and aquatic vegetation growing along sampled channel edges. Three water column wq measurements. Samples collected at high tide, although no tidal influence in the sampling area. Benthic core collected at low tide (exposed mudflat/river channel).	0.5-1.2 ft.
3	Mar 16/15:30	Bridge	South side of estuary in river channel; 15 ft bag seine; pulls 1-3 (approx. 30 ft. in length) were just under and downstream of the Harbor Blvd. Bridge with little aquatic vegetation; pull #4 was approx. 150 feet upstream of the bridge in flooded watercress. Swift streamflow from river, no tidal influence. Benthic sample collected in shallow river channel.	0.2-0.8 ft.
4	Mar 16/16:15	Backwater	Backwater within highly braided river channel, north side of estuary; approximately 800-1000 feet downstream of Harbor Blvd. Bridge; 15 ft bag seine; 3 replicate pulls approx 30 ft. in length. High density of aquatic vegetation.	0.3-0.8 ft.
1	June 24/08:55	Mouth	South side of estuary, adjacent to sand dunes, near estuary mouth; 50 ft bag seine; 2 replicate pulls approx. 50 ft in length. Three water column wq measurements. Benthic sample collected mid-station at depth of 4 feet.	2-4 ft
2	June 24/10:55	Outfall	Area adjacent to and just west of the outfall channel in a small sheltered area behind some stands of giant cane and tules; 15 ft bag seine; 7 replicate pulls ranging in length from 12 feet to 50 feet. High density of aquatic vegetation and debris. Three water column wq measurements. Benthic sample collected mid-station at depth of 4.5 feet.	3.2 ft

Station #	Date/Time	Location	Description	Depth
3	June 24/14:15	Bridge	South side of estuary in river channel approx. 150 feet upstream of the Harbor Blvd. bridge; 50 ft bag seine; 1 seine pull approx. 40 ft in length. High density of aquatic vegetation. Two water column wq measurements (surface & bottom). Benthic sample collected in undisturbed area.	2.6 ft
4	June 24/13:10	Backwater	North side of estuary; approximately 800-1000 feet downstream of Harbor Blvd. Bridge; 50 ft bag seine; 2 replicate pulls approx. 50 ft in length. High density of aquatic vegetation. Benthic sample collected in undisturbed area.	3.2 ft
1	Sept. 20/07:10	Mouth	South side of estuary, adjacent to sand dunes, near estuary mouth; 15 ft bag seine; 3 replicate pulls approx 45 ft. in length parallel to shore; Three water column wq measurements. Benthic core sample collected in approx. 2 feet of water in undisturbed area mid-way in sampling station.	1.8-2.4 ft
2	Sept. 20/08:55	Outfall	Outfall channel approximately 50 feet from confluence with east-side of the river channel and at confluence; 15 ft bag seine; 3 replicate pulls approx 35 ft in length. Tules and aquatic vegetation growing along sampled channel edges. Three water column wq measurements. Benthic sample collected mid-channel at confluence of outfall and River channel.	2.6 ft
3	Sept. 20/12:12	Bridge	Sampled two small scour pools adjacent to Harbor Bridge abutments and one small pool on north bank of river in heavy vegetation; 15-ft bag seine; each pull approx. 12 feet in length; river channel in this area was highly braided and very shallow (0.3 ft). Water quality sampled mid-depth in one of the scour pools; benthic sample collected mid-channel downstream of the bridge.	1 ft
4	Sept. 20/10:40	Backwater	North side of estuary; approximately 800-1000 feet downstream of Harbor Blvd. Bridge; side-channel entering mud-flat; 15-ft bag seine, 3 replicate pulls approx. 45 ft. in length; One water quality sample collected mid-depth. Benthic core collected mid channel.	1-1.3 ft.

2.6 CALCULATION OF REVISED WATER QUALITY OBJECTIVES

The California Toxics Rule (40 CFR 31.38(b)(1) provides the basis for the establishment of numeric limits for priority toxic pollutants for the State of California.

The current discharge limits are set assuming a saltwater ecosystem in the Estuary. The CTR recognizes that "[*a distinct separation generally does not exist between freshwater and saltwater aquatic communities*]" (USEPA, 1997) and has proposed a standard that incorporates a time parameter to better determine when freshwater or saltwater criteria apply. Section 131.38(c)(3) provides the following criteria:

> *"(1) The freshwater criteria apply at salinities of 1 part per thousand (ppt) and below at locations where this occurs 95% or more of the time; (2) saltwater criteria apply at salinities of 10 ppt and above at locations where this occurs 95% or more of the time; and (3) at salinities between 1 and 10 ppt the more stringent of the two apply unless EPA approves the application of the freshwater or saltwater criteria based on an appropriate bioassessment [based on species composition]."*

Using available salinity data and background information, we will demonstrate that salinity in the Estuary tends toward the freshwater end of this gradient, and does not exceed 10 ppt for more than 95% of the time. The bioassessment portions of this study will establish that the species composition of the aquatic community is primarily freshwater with occasional tidal influence.

The exposure pathways used to establish the permit limits for the organic compounds will be evaluated based upon the beneficial uses of water in the Estuary. To the extent appropriate, exposure parameters will be modified to be in better alignment with the beneficial uses.

2.7 BIOACCUMULATION STUDY

An *in situ* bioaccumulation study was initiated during the Summer Bioassessment Survey (September 1999) and is still underway. The purpose of the study is to determine the bioaccumulation levels of the metals COCs associated with the City's discharge. Following California State Mussel Watch protocols, a series of freshwater clams (*Corbicula fluminea*) were deployed in mesh bags within the water column of the discharge channel. The clams will be collected at 30, 60 and 90-day intervals. Samples that survive the longest in the Estuary will be analyzed for tissue concentrations of the metals COCs. This study is expected to conclude in December 1999 with test results available in January 2000. Tissue concentrations will be compared to the State Mussel Watch results as significance criteria.

This section provides detailed results of the bioassessment surveys. Results from existing reports and other studies are also presented in this section. Section 4 provides a discussion of these results with respect to the objectives of this study.

3.1 EVALUATION OF EXISTING DATA

3.1.1 ANNUAL MONITORING REPORTS, OTHER STUDIES

Annual Reports

Since 1995, the Facility has been operating under interim limits for six COCs as shown in Table 3-1. The interim limits are based on the 95% confidence interval of the Facility's historical discharge levels (1990-October 1994). Current discharge levels from 1996-1998 also are presented in Table 3-1 (City of San Buenaventura, 1996, 1997, 1998). During this period, concentrations of the metals and bis(2-ethylhexyl)phthalate did not exceed the interim discharge limits. Dichlorobromomethane exceeded the interim limits on two occasions, but follow-up samples were in compliance (described below).

Table 3-1. Interim Discharge Limits and Actual Discharge Levels (1996-98)

Constituent	NPDES Discharge Limit (µg/L)	NPDES Interim Limit (µg/L)	Drinking Water Standard (µg/L)	Current Discharge Levels (range, 1996-98) (µg/L)	Proportion of samples exceeding Discharge Limit
Copper	2.9	98	1,300	<1.0 – 36.1	34/40
Nickel	8.3	271	100	<2.0 – 66.0	17/39
Lead	8.5	77	15	<3.0 - <200.0	0/34
Zinc	86	1,181	2,000	11 – 144.0	9/39
Bis(2-ethylhexyl)phthalate	5.9	-	6	<2.50	0/4
Dichlorobromomethane	22	70	60	7.9 – 89.8	2/8

< indicates non-detected result at specified detection limit

The source of zinc in the wastewater was identified as zinc orthoposhphate, a corrosion control additive in the water supply. Since 1995, the use of this additive has been discontinued, resulting in near compliance for zinc. All samples since September 1997 have met the discharge limit.

Lead and bis(2-ethylhexyl)phthalate have not been detected in the Facility's discharge since 1996. Improvements in analytical techniques, especially for organics, have resulted

in lower method detection limits and increased measurement precision for these COCs. Artificially high detection limits available in previous analytical techniques may have contributed to previous "non compliance" for these COCs.

Since 1996 concentrations of dichlorobromomethane are, in general, below the NPDES permit limit levels. In 1998, two effluent samples exceeded the interim limits. Follow up samples were in compliance with the NPDES limits. The source of this compound is unidentified and continues to be uncontrolled.

Eighty-five percent of the copper samples and 45% of the nickel concentrations exceed the NPDES Discharge Limit. All samples are within the Interim Limit levels every year since the Interim Limits were implemented. For copper, concentrations measured since January 1997 have not exceeded 25 ug/L.

Ambient Monitoring

Since 1996, the City has monitored ambient water concentrations of metals at three locations in the Santa Clara River. These locations are described in detail in the Facility's annual monitoring reports (City of San Buenaventura, 1996, 1997, 1998). Their general location descriptions are:

> *Station L5*: Santa Clara River, approximately one mile east of the Harbor Blvd. Bridge, upstream on the Victoria Blvd. Bridge.
>
> *Station R1*: Mid-Estuary where the Santa Clara River flow enters the tidal prism, upstream of the Facility's discharge.
>
> *Station R2*: Mouth of the Estuary along the south shore, opposite of the Facility's discharge channel.

Table 3-2 presents the results of the ambient monitoring program. Measured samples for copper and nickel exceed the NPDES Discharge Limits at all stations, including station L5 which is out of the influence of the Facility's discharge, and station R1 which likely has minimal discharge influence. There is no significant variation among these stations in the proportion of samples which exceed the discharge limit. Zinc concentrations exceed the discharge limit only at Station L5. Lead was undetected at all stations.

Table 3-2. Metals Concentrations at Ambient Monitoring Stations in the Santa Clara River and Estuary 1996 - 1998.

		Copper	Nickel	Lead	Zinc
L5	Range (µg/L)	<1.4 - 139.0	<2.4 - 175.5	<3.2 - <25.0	<9.10 – 179.0
	Proportion exceeding Discharge Limit	18/23	13/23	0/22	7/23
	Proportion of Non-Detected Values	5/23	4/23	22/22	3/23
R1	Range (µg/L)	<1.4 – 39.7	<2.4 – 39.1	<3.2	<9.1 – 59.9
	Proportion exceeding Discharge Limit	4/6	2/6	0/2	0/6
	Proportion of Non-Detected Values	2/6	1/6	2/2	3/6
R2	Range (µg/L)	<1.4 – 41.2	3.8 – 44.2	<3.2	<9.1 – 63.3
	Proportion exceeding Discharge Limit	8/10	5/10	0/2	0/10
	Proportion of Non-Detected Values	2/10	0/10	2/2	3/10

3.1.2 VENTURA PORT DISTRICT STUDY

In 1998, the Ventura Port District conducted a study of contaminant levels in the nearby Ventura Harbor, Santa Clara River and barrancas that discharge to the river (unpublished data of Merritt-Smith, 1999). A portion of this study measured ambient concentrations of metals and organic compounds in the river at the rivermouth (Estuary) and at the Victoria Street Bridge, one mile upstream from the Pacific Ocean. Table 3-3 provides the ambient concentrations of the COCs from this study.

The results of the Port's contaminant study show the following:

- 1998 ambient concentrations of zinc, lead and both organic compounds are within the NPDES discharge limit levels, both at the Victoria Street Bridge and in the Estuary.

- Ambient concentrations for copper and nickel do not meet the NPDES Discharge limits, even at the Victoria Street Bridge one mile upstream of the Facility's discharge.

Table 3-3. Ambient Levels of Constituents of Concern in the Santa Clara River September 1998 (Merritt-Smith 1999)

Constituent	Victoria St. Bridge (µg/L)	Estuary (µg/L)	NPDES Discharge Limit (µg/L)
Copper	6.3	15	2.9
Nickel	12	26	8.3
Lead	Not detected	Not detected	8.5
Zinc	7.5	43	86
Bis(2-ethylhexyl)phthalate	Not detected	Not detected	5.9
Dichlorobromomethane	Not detected	Not detected	22

The Port's study also measured hourly salinity at the Harbor Boulevard. Bridge and at the mouth of the Estuary. Dates and a summary of the metering results are presented in Table 3-4. Figures 3-1 to 3-5 present graphs of the temporal variation in the salinity measurements over the measured days.

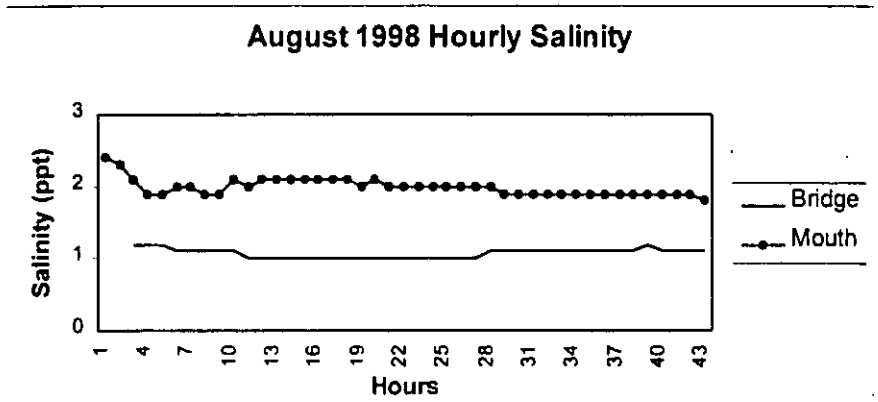
Table 3-4. Summary of Hourly Salinity Measurements in the Santa Clara River Estuary August 1998-January 1999 (Merritt-Smith data)

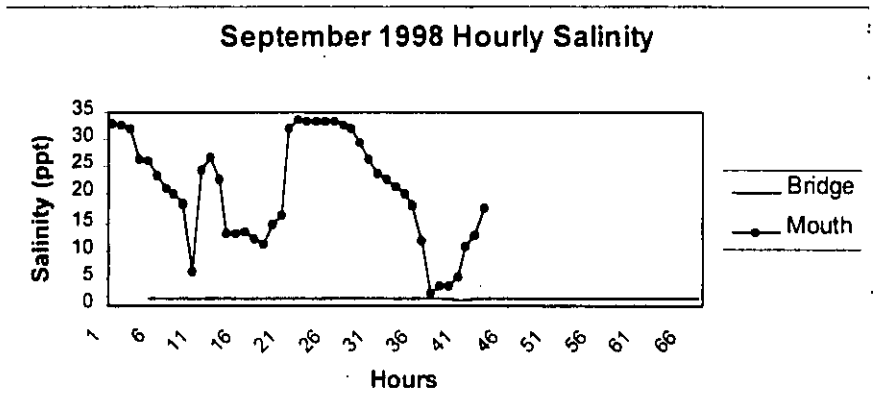
Dates	Harbor Blvd. Bridge (ppt)	River Mouth (ppt)	Tidal Influence	Percent of time >10 ppt
August 12-13, 1998	1.0-1.2	1.9-2.4	No	0
September 10-12, 1998	0.93-1.26	3.7-33.5	Yes	88%
October 27-29, 1998	0.81-1.08	2.1-18.2	Some	54%
December 3-5, 1998	1.0	3.0-33.0	Yes	80%
January 24-25, 1999	0.4-1.0	1.0-30.0	Yes	21%

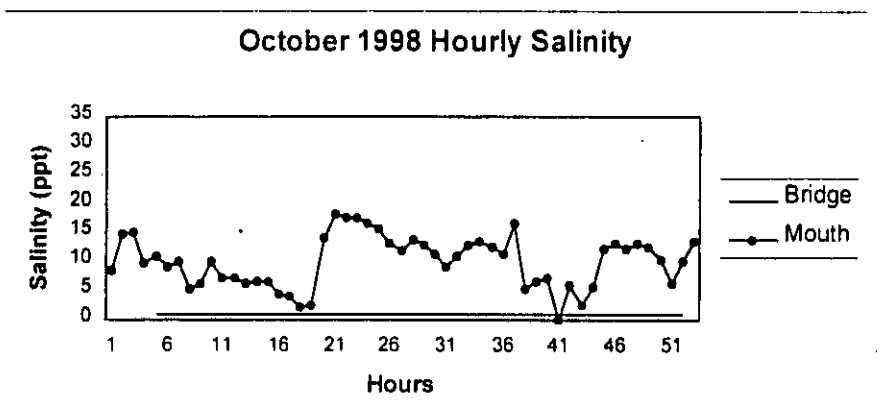
Data from these dates show tidal influence at the river mouth when the sand bar is breached. It can be assumed that the sand bar was intact in August, as there is no evidence of tidal influence at the rivermouth sampling station and only small variation in salinity over the time period sampled. October shows some tidal influence in the estuary, but to a lesser degree than that seen in September, December and January. It may be that the tides at this time were lower, or that river flow off-set the incoming tide. Tidal influence is

clear in September, December and January, although this influence does not reach as high into the Estuary as the Harbor Boulevard Bridge.

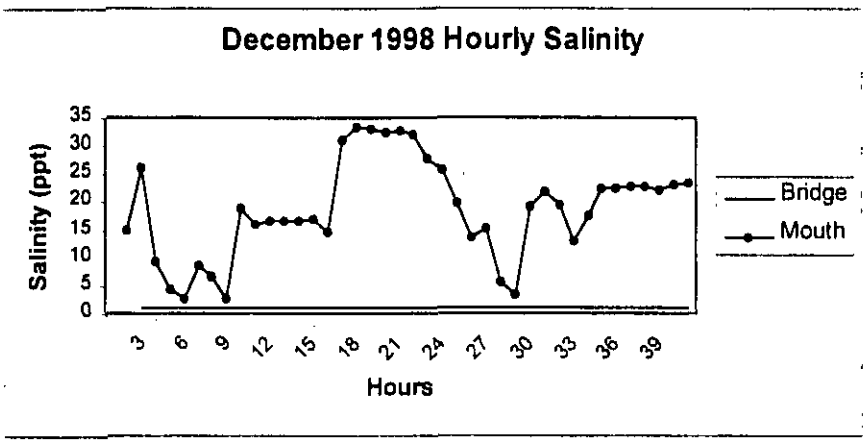
Sand bar breaching is most common during the winter storm months (approximately December through March). The mouth of the Estuary can also be open when water pressure from the impounded embayment forces a breach in the sand bar. Much of the year the Estuary is cut off from the ocean and receives little tidal influence. These results show that at the mouth of the Estuary even when tidal influence is strongest, salinities do not remain above 10 ppt for more than 95% of the period, one of the CTR criteria of a saltwater system. Therefore, according to the California Toxics Rule, the Estuary may be tested to determine if it supports a freshwater or saltwater ecosystem.

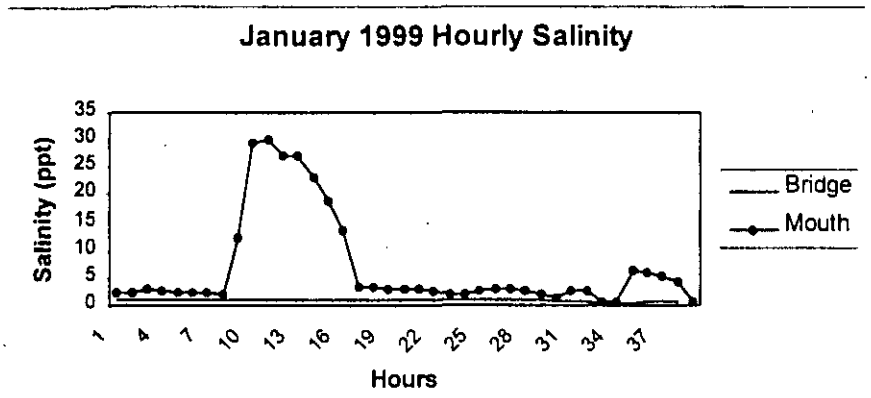






Figures 3-1 to 3.3. 1998/99 Hourly Salinity Measurements in the Santa Clara River Estuary (Merritt-Smith data). Refer to Table 3-4 for sampling dates.





Figures 3-4 to 3-5. 1998/99 Hourly Salinity Measurements in the Santa Clara River Estuary (Merritt-Smith data). Refer to Table 3-4 for sampling dates.

3.1.3 STATE PARK DATA

Preliminary results (G. Greenwald, pers. comm.) of a two-year, bimonthly survey of the aquatic ecology of the Estuary indicate that the ecosystem is a brackish to freshwater community. The predominant species of vegetation, fish, invertebrates and benthic infauna consist of freshwater to mildly brackish species. The water is primarily fresh (approximately 250-300 days per year) with tidal influence when the sand bar at the mouth of the Estuary is breached. Measured salinity in the upstream portion of the Estuary varies from 0.6-1.1 ppt. Salinity at the mouth ranges from 0.6-33 ppt. Because of the sand bar, this Estuary does not behave as a typical estuary with regular tidal fluctuations. When the sand bar is intact, the water in the Estuary more closely resembles a freshwater lagoon. Only when the sand bar is breached does marine water flood the Estuary. The sand bar is breached most frequently during winter storms when stream flow from the Santa Clara River is high, further minimizing the influx of marine water.

3.1.4 INTERVIEWS

The comments and professional judgements of local authorities in terrestrial vegetation, avifauna, ichthyology, benthic infaunal communities and natural reserve resources are summarized below. A list of the experts consulted, and their professional affiliations, are provided in Section 6, *List of Consulted Experts*.

Birds

The Estuary provides critical habitat for migratory and resident populations of water birds and shore birds. The American Bird Conservancy classifies the Estuary as a World-class observation area for migratory birds. The Point Reyes Bird Observatory conducts regular breeding surveys of Snowy Plovers and Least Terns, maintaining a database on these state and federally listed threatened and endangered species. The Ventura County Chapter of the Audobon Society also performs breeding surveys of Least Terns maintaining a database on seasonal abundance and reproductive success. The Audobon Society annually constructs protective fencing around Least Tern nesting areas during breeding season to reduce damage and predation to the nests.

The Estuary and Mugu Lagoon to the south, are the most important estuarine habitats for migrating birds in Ventura and Santa Barbara Counties. Many species fly over potential locations in San Diego and Santa Monica Bays to reach these two preferred locations.

Federally-listed Brown Pelicans, which nest in the Channel Islands, utilize the Estuary as a resting and roosting area. They feed in the waters off-shore of the Estuary.

Vegetation and Terrestrial and Aquatic Fauna

The ecological diversity of the Estuary is at least equal to or exceeds that seen in other local estuarys (e.g., Malibu Creek, Ventura River, Mugu Lagoon). It supports a number of state and federally listed endangered species and candidate species of concern

including the tidewater goby, two-stripe garter snake, South Coast garter Snake, and Southern California Steelhead. The South Coast garter snake is near extinction and is found in only two other locations outside the Santa Clara River. The Estuary is one of four locations in the River where the snake is known to exist. California red-legged frogs are could potentially occur in the Estuary (not documented) when salinities are low or to use the Estuary as a migratory corridor.

The freshwater input from the Facilty is essential to maintaining a perennial, dynamic freshwater environment and habitat. Reduction in freshwater flow would likely cause a shift to more saline conditions. The already limited area of riparian forest near the discharge channel on the north bank of the Estuary would likely retreat further upstream.

The riparian forest and salt marsh areas of the Estuary comprise what remains of the historic Santa Clara River Estuary. Reduction in the Facility's discharge could result in colonization by exotic species. The rare salt marsh bird's beak, which has been observed in the Estuary, is locally known to respond favorably to fresher water.

If fresh water eventually causes the salt marsh to transition to more brackish or freshwater conditions (i.e., soil salinity is diminished), the resulting vegetative composition would not necessarily be detrimental. The salt marsh acreage would likely become a freshwater-emergent wetland, which would not constitute a net loss.

3.2 BIOASSESSMENT SURVEY WEATHER, TIDE CONDITIONS AND WATER QUALITY

3.2.1 WEATHER AND TIDES

Winter Survey

Winter 1998/99 was a relatively dry year in Ventura County. By the end of March, annual precipitation in the City of Ventura was 56% of normal and 52% of normal on the Oxnard Plain (7.02 inches compared to 12.38 inches normal and 6.51 inches compared to 12.53 inches normal, respectively). The March 1999 surveys were conducted during relatively normal seasonal conditions for the study area. Early morning precipitation occurred on March 9 and 11, ending by 0900 each day (0.36 inches). A low-pressure cold front generated windy conditions on March 9 and 10, while March 11 and 12 were generally breezy. A storm event preceded the aquatic sampling (0.82 inches) depositing snow in the local mountains. Weather conditions during the aquatic sampling were cool and partly cloudy.

The predicted tides for the period are presented in Table 2-1. There was large tidal fluctuation during the terrestrial surveys, with water flooding and receding from the marshes, mudflats and ditch between the sand dunes and sand bar. Tides during the aquatic sampling were the most extreme of the month, whereas moderate tides and river flow during the vegetation survey resulted in the Estuary remaining flooded during the day.

Spring Survey

Weather conditions for the late Spring surveys were typical of the area for June. Air temperatures were mild during the days (approximately 65-70 degrees F) with a marine layer of overcast persisting through the morning hours and often throughout the entire day. Winds were mild during the days, often increasing during the afternoons. There had been no precipitation prior to the Spring surveys.

The predicted tides for the survey days are presented in Table 2-1. The sand bar was intact during the Spring survey, so tidal influence on the Estuary was unnoticeable.

Summer Survey

The weather preceding the Summer Survey days was clear and warm. Air temperatures ranged from 59 degrees F in the morning of the aquatic survey to 79 degrees F in the shade in the afternoon. Light precipitation fell during the Summer vegetation survey, with accompanying cooler air temperatures and a light breeze.

The Summer aquatic survey was designed to sample the Estuary during low flow conditions, preferably with the mouth of the Estuary open to the ocean and during a high tide. The sand bar, which had been breached for two months prior to the survey, closed during the night prior to the survey day and the Estuary began to flood with fresh water. The survey captures the influence of the previous two months of tidal fluctuation. The predicted tides for the survey days are presented in Table 2-1.

3.2.2 Streamflow and Lagoon Status

Winter

Streamflow from the Santa Clara River during the Winter survey period were relatively low for the season. Rainfall from a late storm and subsequent runoff resulted in increased streamflow as compared to previous weeks. The Facility outfall was the significant contributor to overall streamflow in the lagoon. The sandbar breached prior to the surveys and remained open during the two-week survey period. The lagoon was observed in several different hydraulic conditions during the survey.

On March 9 the lagoon was moderately full and tidal influence was apparent with a low tide condition observed in the late afternoon. On March 10, the lagoon was fuller than on the previous day with many of the meanders submerged. Consistent with the predicted tides (high low-tide) and storm runoff, over the course of the day the lagoon became very full and no tidal fluctuation was observed. On March 11, the streamflow and lagoon conditions were similar to March 9 with tidal fluctuation observed. During the morning of that day (March 11) the lagoon was actively discharging (ebbing tide) to the ocean to the extent that sandbar erosion was observed. On March 12, tidal fluctuations were observed in the Estuary.

March 16th surveys began just after high tide (9am). At this time, the Estuary was quite full with most meanders submerged and depth across the Estuary greater than five feet. Streamflow from the river was moderate (as compared to the week of March 1st) reflecting runoff from the previous night's storm. The Estuary was actively discharging through the sandbar breach. The current was strong at this point, erosion of the breach was high and inflow from the ocean was not visible. Tidal fluctuation in the Estuary was high, as the tide continued to recede to a low at 2:51 pm. At low tide, most of the mudflat was exposed. By 6:10 pm, the mudflats were still exposed, but ocean waves were visibly entering the Estuary mouth. On March 17th, surveys began at high tide (9am). Compared to the previous day, the Estuary was not as full, with portions of the mudflat exposed.

Spring

Streamflow in the Santa Clara River was relatively low during the Spring survey with the predominant flow along the northern bank. Water diversions at the Vern Freeman Diversion upstream were near 100% during this time and there had been no recent precipitation.

The sandbar forming the lagoon had not breached since April. Consequently, the Estuary was inundated with water flowing downstream from the Santa Clara River and from discharge from the water treatment plant. In the Winter survey, the Estuary consisted of a mudflat with shallow river channels flowing to the ocean. During this survey, the Estuary was a deep lagoon (estimated greater than 9 feet deep in the center). Contrasted with the Winter survey, tidal influence in the Estuary was minimal.

Summer

As expected for a Southern California river in summer, flows in the Santa Clara River were low during the Summer Survey. Water diversion and the Vern Freeman Diversion continued to be nearly 100%. The mouth of the Estuary had been open since mid-July. Observations on the day before the aquatic survey revealed exposed mudflats with a shallow, braided river channel. The Facility's discharge created a second, low flow channel to the river mouth and out to the ocean. High tide flooded the Estuary with ocean water. The sandbar closed during the night and the mouth of the Estuary was newly closed on the morning of the aquatic surveys. The Estuary was beginning to flood with fresh water.

Appendix A provides photos of the Estuary during inundated and dry conditions (sand bar open). Each aquatic sampling station was photographed.

3.2.3 Water Quality Results

Water quality across the Estuary showed low salinity and high levels of hardness in all three seasonal surveys. As noted, the three surveys captured the Estuary when the mouth was open on a receding high tide (Winter survey), with the mouth closed in a highly flooded condition (Spring survey) and just after the mouth closed on a high tide (Summer

Survey). Table 3-5 presents the mid-depth salinity and hardness measurements and the average water column temperature of the water column (average of surface, mid-depth and bottom measures, where applicable). In general, no distinct salt wedge was noted.

Winter

Salinity was lowest at the upstream Bridge and Backwater stations (stations 3 and 4, respectively) and slightly higher at the downstream mouth and outfall stations (stations 1 and 2). This result likely reflects the relatively high river flow from the recent storm and the influence of the high tide at the downstream stations. Water temperature at the mouth station was five degrees cooler than the upstream stations also reflecting the marine influence and the early morning temperature. Only Station 1 had sufficient depth to collect surface, mid-depth and bottom measures of water quality parameters. There was minimal water column stratification.

In addition to the sampling stations, three mid-depth, *in situ* salinity measures across the mouth of the Estuary on the morning of March 16th ranged from 0.6-0.9 ppt. These measurements were collected at 11:00 am on a receding tide (Table 2-1). Although the tide had turned three hours earlier, the Estuary was still quite full at the time of these measurements, due to the extreme height of the tide and runoff/river flow from the previous day's storm event.

Spring

Water temperature, salinity and water hardness were consistent across the Estuary. These results are likely due to the stable nature and low river flows in the Estuary since late April. Water hardness is slightly lower in the discharge measured in the outfall channel.

Summer

Mid-water salinity was slightly higher at the backwater and mouth stations, relfecting recent tidal influences. Water quality profiles (top, mid-depth, bottom) were collected at Station 1 (mouth) and Station 2 (outfall). These measures showed some stratification of the water column with slightly higher salinities at the bottom. Salinity ranges at Station 1 varied from 2.6 ppt at the surface to 4.0 ppt at the bottom. Similarly, the salinity profile at the outfall station ranged from 1.0 ppt at the surface to 3.4 ppt at the bottom. Water temperatures were one degree cooler at the surface than at the bottom in these early morning surveys.

Table 3-5. Water Salinity, Hardness and Temperature in March, June and September, 1999.

	March 1999			June 1999			September 1999		
	Winter			Spring			Summer		
Station # and Location	Salinity (ppt)	Hardness (mg/l)	Temperature (°C)	Salinity (ppt)	Hardness (mg/l)	Temperature (°C)	Salinity (ppt)	Hardness (mg/l)	Temperature (°C)
1 Mouth	1.3	680	13.8	1.9	660	20.6	2.8	1000	17.9
2 Outfall	1.1	470	17.7	1.2	470	21.1	1.1	470	20.6
3 Bridge	0.7	580	18.8	1.6	710	21.8	1.4	1000	24.8
4 Backwater	0.8	620	18.1	1.6	700	21.8	3.0	980	18.0

3.3 VEGETATION SURVEY

The Santa Clara River Estuary supports a variety of vegetation types, including riparian forest stands with varying mixtures of freshwater marsh, brackish marsh and salt marsh species, mudflats, and sand dunes. These are discussed in detail in the following sections, with the exception of the sand dunes (which are outside the scope of this study). Table 3-6 presents a list of all vegetation species observed in the three seasonal surveys. Figures 3-6 and 3-7 present the vegetation units mapped during the three surveys.

3.3.1 MARSH

A marsh area lies on the south side of the estuary, immediately east of the dunes along the ocean. The marsh area is almost completely covered with vegetation. Occasional unvegetated areas result from trails or debris deposits, and from channels or ponds with standing water

A levee through the marsh area on the south side of the estuary divides the marsh into two parts. According to CDPR personnel, the end of this levee extended into the Estuary and was removed by the river in the winter of 1998-99 (Figure 3-6). During the winter survey, the marsh east of the levee was vegetated primarily by bulrush (*Scirpus californicus*), silverweed (*Potentilla anserina* ssp. *pacifica*), yerba mansa (*Anemopsis californica*), water smartweed (*Polygonum amphibium*), and poison hemlock (*Conium maculatum*).

The marsh on the western side of the levee was quantitatively sampled. This area was dominated by saltgrass (*Distichlis spicata*), jaumea (*Jaumea carnosa*), and alkali heath (*Frankenia salina*), as well as patches of pickleweed (*Salicornia virginica*). However, the ponded areas along the far western side of the marsh, adjacent to the dunes, supported bulrush (*Scirpus californicus*), silverweed and spiny rush (*Juncus acutus* spp. *leopoldii*). While the saltgrass, alkali heath, and pickleweed are most abundant at the north end of the marsh adjacent to the estuary, saltgrass, pickleweed, jaumea, and horned sea-blite (*Suaeda calceoliformis*) are also found in and adjacent to the campground.

In September, alkali mallow (*Malvella leprosa*) was growing in the area at the northwest end of the marsh, among the stems of the previous year's pickleweed and alkali heath. Some pickleweed and alkali heath had begun active growth in this area. This area was inundated with water during the spring survey.

The western side of the marsh is edged by a channel that conveys water south to a thicket of willows adjacent to the campground. The channel is dominated by tule (*Scirpus californicus*) and rush (*Juncus acutus* spp. *leopoldii*). Along the southeastern end of the marsh is an area dominated by wild rye. A section to the west of the trail along the west side of the diked marsh has vegetation typical of the marsh, rather than the dunes. The extension of the marsh vegetation (primarily stands of alkali heath) to the west side of the trail is recent (T. Munro, pers. comm.).

A central portion of the marsh supports a mixture of the salt marsh species and taller species such as marsh baccharis (*Baccharis douglasii*), western goldenrod (*Euthamnia occidentalis*), and slender aster (*Aster subulatus* var. *ligulatus*). Myoporum shrubs (*Myoporum laetum*) of various sizes are also present in this area, as are iceplant (*Carpobrotus edulis*) and poison oak (*Toxicodendron diversiloba*). At the south end of this section, mugwort (*Artemisia douglasiana*), heliotrope (*Heliotropium curassavicum*) and California figwort (*Scrophularia californica*) were also present. Beardless-wild rye (*Leymus triticoides*), and yerba mansa (*Anemopsis californica*) form extensive stands in the southern end of the marsh. Willows are also present at the southwest corner of the marsh. These vegetation stands are not mentioned in the main text of the McGrath State Beach Restoration and Management Plan (Swanson, et al, 1990), and may represent changing patterns in the marsh vegetation.

The low area east of the levee was mostly inundated in June. The channel was filled with silverweed, water smartweed (*Polygonum* cf. *amphibium*), mulefat (*Baccharis salicifolia*), and myoporum. Willows (*Salix* spp.) were present along the east side of the channel. Yerba mansa extended well up the side of the levee, reaching the top in some places. Yerba mansa did not extend this high on the levee in previous years (T. Munro, pers. comm.).

In September, horned sea-blite was found in the campground in an area that also had pickleweed and salt grass. The horned sea-blite plants were very distorted, apparently as a response to repeated mowing in this area. There is no apparent incursion of giant reed in the salt marsh at this time.

Table 3-7 provides a list of the species documented in the marsh and their relative abundances. Figure 3-8 charts the relative abundances of each species.

Table 3-6. Vegetation Species List: from 1999 Surveys of the Santa Clara River Estuary.

Common Name	Scientific Name	Not listed in 1976 EIR	Dunes only	Names used in 1976 EIR (if different from nomenclature in Hickman)
Silver beachweed	*Ambrosia chamissonis*		*	
Western ragweed	*Ambrosia psilostachya*			*Ambrosia psilostachya* var. *californica*
Yerba mansa	*Anemopsis californica*	*		
Celery	*Apium graveolens*			
Mugwort	*Artemisia douglasiana*			
Giant reed	*Arundo donax*			
Slender aster	*Aster subulatus* var. *ligulatus*			*Aster sp.*
Saltbush	*Atriplex lentiformis* ssp. *lentiformis*			*Atriplex lentiformis breweri*
Spearscale	*Atriplex triangularis*			*Atriplex patula* ssp. *hastata*
Marsh baccharis	*Baccharis douglasii*			
Coyote bush	*Baccharis pilularis*			*Baccharis pilularis* ssp. *consanguinea*
Mule fat	*Baccharis salicifolia*			*Baccharis glutinosa/viminea*
Black mustard	*Brassica nigra*			
Ripgut brome	*Bromus diandrus*			*Bromus* sp.
Soft chess	*Bromus hordeaceus*			*Bromus* sp.
Sea-rocket	*Cakile maritima*		*	
Beach morningglory	*Calystegia* sp.		*	*Convolvulus cyclostegia*
Beach evening-primrose	*Camissonia cheiranthifolia* ssp. *suffruticosa*		*	*Oenothera c.* var. *s.*
Hoary cress	*Cardaria draba*			
Hottentot-fig	*Carpobrotus edulis*			
Star-thistle	*Centaurea* sp.	*		
Lamb's quarters	*Chenopodium album*			
Epazote, Mexican tea	*Chenopodium ambrosioides*	*		
Poison hemlock	*Conium maculatum*			
various	*Conyza* sp.	*		
Pampas grass	*Cortaderia sp.*	*		
Brass buttons	*Cotula coronopifolia*			
Bermuda grass	*Cynodon dactylon*			
Umbrella-sedge	*Cyperus eragrostis*			
Saltgrass	*Distichlis spicata*			*Distichlis spicata* var. *spicata*
Western goldenrod	*Euthamnia occidentalis*	*		
Sweet fennel	*Foeniculum vulgare*			
Alkali heath	*Frankenia salina*			*Frankenia grandifolia*

Common Name	Scientific Name	Not listed in 1976 EIR	Dunes only	Names used in 1976 EIR (if different from nomenclature in Hickman)
Heliotrope	*Heliotropium curassavicum*			
Telegraph weed	*Heterotheca grandiflora*			
Mediterranean mustard	*Hirschfeldia incana*	*		
Mediterranean barley	*Hordeum marinum* ssp. *gussoneanum*			
Foxtail	*Hordeum murinum*			*Hordeum glaucum (H. stebbinsii)*
Jaumea	*Jaumea carnosa*			
Spiny rush	*Juncus acutus* spp. *leopoldii*			*Juncus acutus* var. *sphaerocarpus*
Toad rush	*Juncus bufonius*			
Rush, creeping	*Juncus* sp.			
Beardless-wildrye	*Leymus triticoides*			*Elymus triticoides*
Bird's foot trefoil	*Lotus corniculatus*	*		
Lupine	*Lupinus* sp.	*		
Cheeseweed	*Malva parviflora*			
Alkali mallow	*Malvella leprosa*			*Sida leprosa* var. *hederacea (S. hederacea)*
Horehound	*Marrubium vulgare*			
California bur-clover (not native)	*Medicago polymorpha*	*		
Yellow sweet-clover	*Melilotus indicus*			
Myoporum	*Myoporum laetum*	*		
Water-cress	*Nasturtium officinale*			
Yellow water weed	*Ludwigia peploides* var. *peploides*			
Hooker's evening-primrose	*Oenothera elata* ssp. *hirsutissima*	*		
Bermuda-buttercup	*Oxalis pes-caprae*			
Smilo grass (Ricegrass)	*Piptatherum milaceum*			*Oryzopsis miliacea*
Common plantain	*Plantago major*			
Marsh fleabane	*Pluchea odorata*	*		
Bristly ox-tongue	*Picris echioides*	*		
Water smartweed	*Polygonum amphibium*			*Polygonum amphibium* var. *stipulaceum*
Beardgrass	*Polypogon monspeliensis*			
Black cottonwood	*Populus balsamifera* ssp. *trichocarpa*			*Populus* sp.
Fremont cottonwood	*Populus fremontii* ssp. *fremontii*			*Populus* sp.
Silverweed	*Potentilla anserina* ssp. *pacifica*			*Potentilla egedei* var. *grandis*

Common Name	Scientific Name	Not listed in 1976 EIR	Dunes only	Names used in 1976 EIR (if different from nomenclature in Hickman)
Wild radish	*Raphanus sativus*			
Castor-bean	*Ricinus communis*			
California blackberry	*Rubus ursinus*	*		
Curly Dock	*Rumex crispus*			
Pickleweed	*Salicornia virginica*			
Narrow-leaved willow	*Salix exigua*			
Arroyo willow	*Salix lasiolepis*			
Three-square	*Scirpus americanus*			*Scirpus olneyi*
California bulrush	*Scirpus californicus*			*Scirpus validus*
Common three-square	*Scirpus pungens*			
Robust bulrush	*Scirpus robustus*			
California figwort	*Scrophularia californica*	*		
Nightshade	*Solanum* sp.			*Solanum douglasii* and *S. nodiflorum*
Prickly sow thistle	*Sonchus asper*	*		
Sow thistle	*Sonchus oleraceous*			
Horned sea-blite	*Suaeda calceoliformis*			
New Zealand spinach	*Tetragonia tetragonioides*			
Poison oak	*Toxicodendron diversifolium*	*		
Clover	*Trifolium* sp.			
Cat-tail	*Typha* sp.			*Typha domingensis*
Cocklebur	*Xanthium strumarium*			*Xanthium strumarium* var. *canadense*
Grass	unidentified annual grasses			

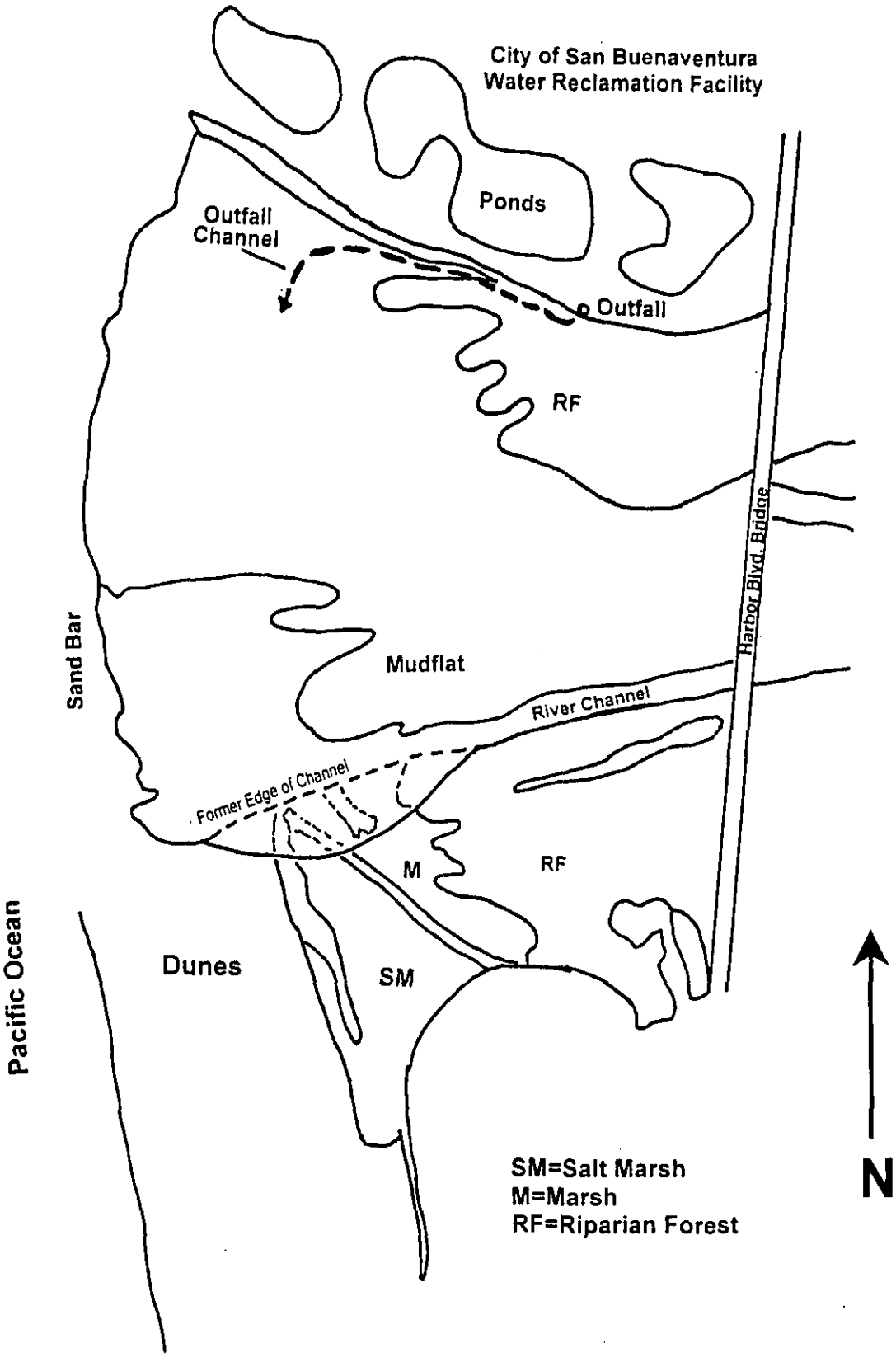


Figure 3-6. 1999 Vegetation units of the Santa Clara River Estuary.

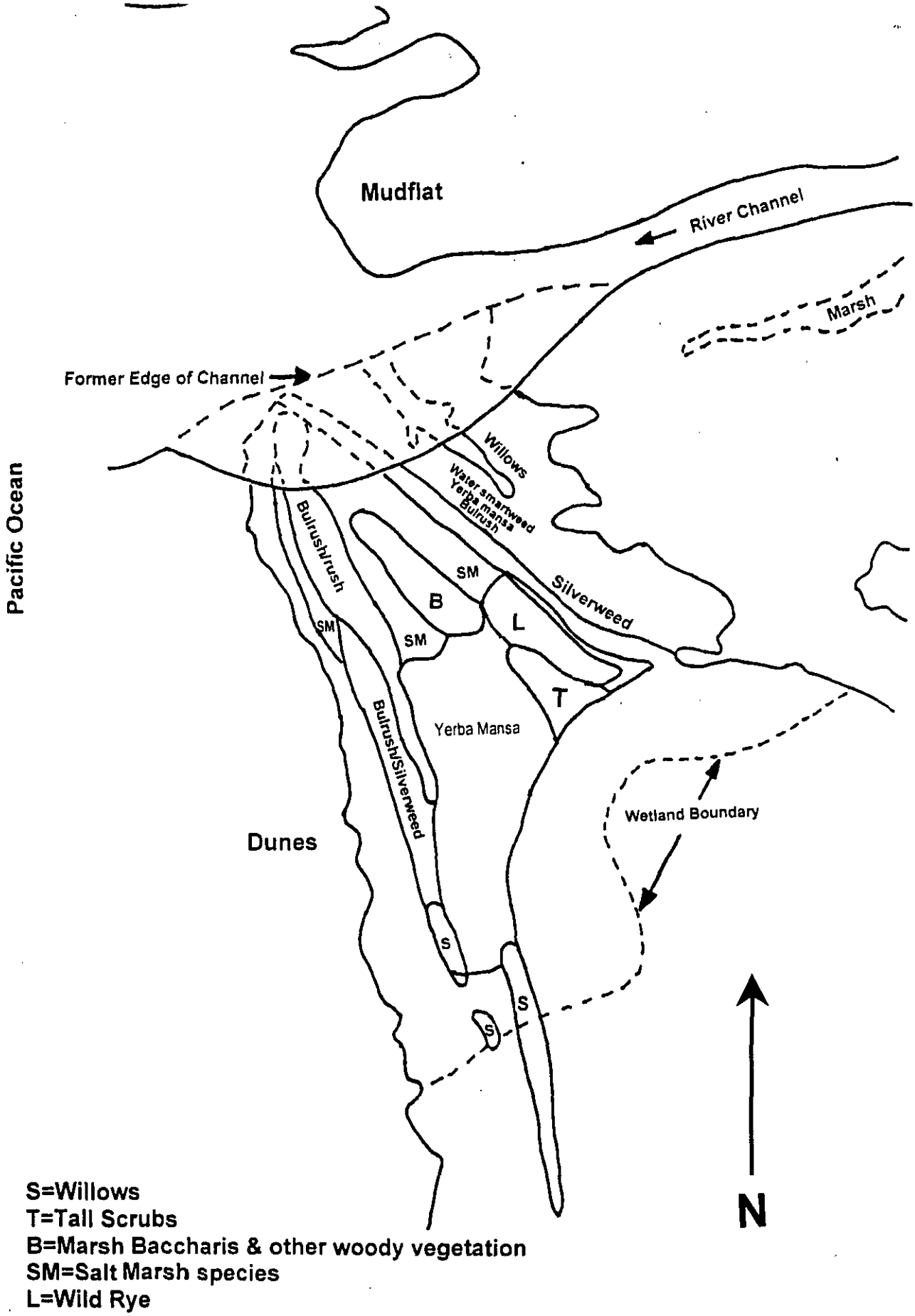


Figure 3-7. 1999 Vegetation units of the marsh habitat, Santa Clara River Estuary.

Table 3-7.Vegetations Species and Percent Cover for the Marsh Survey.

Species	Total Length for Species (meters)	Percent Cover
Silver beachweed	9.66	1.17%
Quail bush	0.03	0.00%
Marsh baccharis	7.28	0.88%
Coyote brush	11.53	1.40%
Mule fat	0.52	0.06%
Ripgut brome	4.9	0.59%
Hottentot-fig	2.82	0.34%
Clematis	0.18	0.02%
Saltgrass	387.13	46.98%
Western goldenrod	10.02	1.22%
Alkali heath	81.03	9.83%
Unidentified seedling	0.05	0.01%
Mustard	0.05	0.01%
Jaumea	113.07	13.72%
Spiny rush	0.3	0.04%
Myoporum	2.03	0.25%
Silverweed	38.12	4.63%
Curly dock	9.73	1.18%
Willow	0.61	0.07%
Pickleweed	54.56	6.62%
Bulrush, tall	53.72	6.52%
Bulrush, short	0.02	0.00%
Clover	0.05	0.01%
Cocklebur	0.87	0.11%
Open water	21.52	2.61%
Bare/debris	14.2	1.72%
Total Vegetative Cover	788.28	95.67%
Total Length of Transects	842	

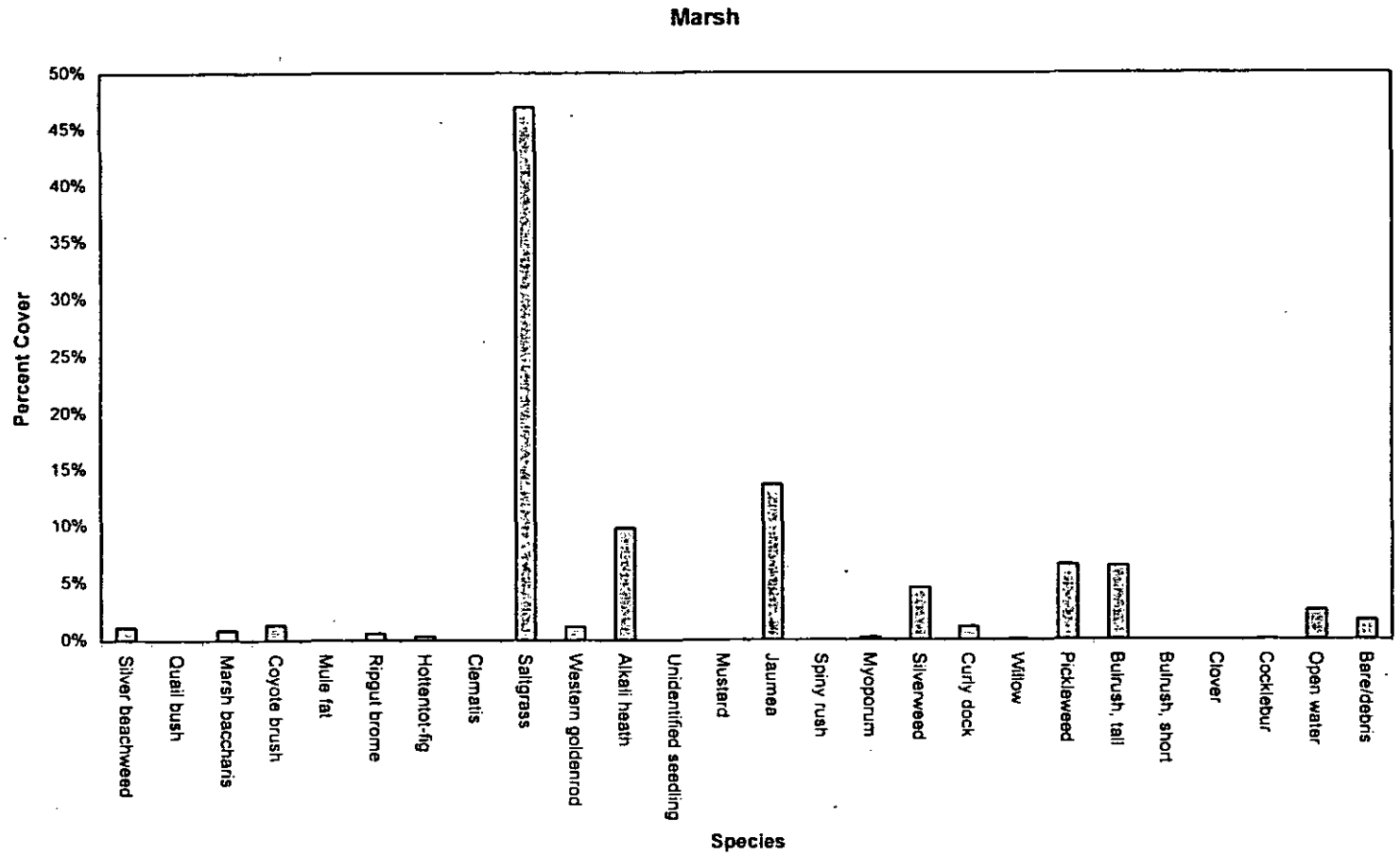


Figure 3-8. Relative Abundance of Marsh Vegetation Species.

3.3.2 RIPARIAN FOREST

The riparian forest areas consist of dense willow (*Salix lasiolepis* and *Salix exigua*) with a dense understory of poison oak (*Toxicodendron diversifolium*), California blackberry (*Rubus ursinus*), other native riparian understory species, and the invasive exotic, giant reed (*Arundo donax*). Scattered cottonwood trees (both Fremont cottonwood (*Populus fremonitii*) and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*)) are also present on the south side of the river.

3.3.3 MUDFLAT

The central part of the estuary, where the river and tidal flows are most active, is a mosaic of mudflats, stands of giant reed, bulrush, and occasional clumps of willows (on higher ground and at the margins).

In the Winter survey, the central mudflat that was quantitatively sampled when exposed at low tide, but was largely bare. Only twelve percent was vegetated. Species present included bulrush (*Scirpus* sp.), nutsedge (*Cyperus* sp.), rush, Baccharis spp., marsh fleabane (*Pluchea odorata*), and brass buttons (*Cotula coronopifolia*). As mentioned above, cottonwood seedlings and celery plants (*Apium graveolens*) were present on the mud flat, as well as occasional individuals of other species.

In the Spring survey, the mudflats in the center of the estuary were flooded and inaccessible because the estuary was closed and the water was high. Only a few stems of giant reed (*Arundo donax*) were visible above the water.

The estuary was partially inundated during the summer survey. Exposed portions not dominated by giant cane were dominated by two vegetation types. A smaller area at the southwestern end, in the vicinity of the quantitative sampling conducted in March, was sparsely vegetated with slender aster, marsh baccharis, mulefat, rush, and spikerush (*Eleocharis* spp.). One plant of alkali heath and two plants of yerba mansa were present at the western end of the mudflat. The more easterly portion, approaching the bridge, was vegetated primarily by water speedwell (*Veronica anagallis-aquatica*).

Table 3-8 provides a list of the vegetation species, and their relative abundances, recorded on the tidal mudflats. Figure 3-6 charts this same information.

Table 3-8. Relative Abundance of Tidal Mudflat Vegetation Species.

Species	Total Length for Species (meters)	Percent Cover
Western ragweed	0.06	0.01%
Celery	0.67	0.07%
Giant reed	0.17	0.02%
Slender aster	14.2	1.43%
Mule fat	0.34	0.03%
Brass buttons	0.39	0.04%
Bermuda grass	1.54	0.15%
Pinnate leaf seedling	0.27	0.03%
Grass	2.29	0.23%
Epazote	0.43	0.04%
Spiny rush	1.61	0.16%
Rush, creeping	16.89	1.70%
Bird's foot trefoil	0.55	0.06%
Mallow	0.11	0.01%
Watercress	0.22	0.02%
Common plantain	0.28	0.03%
Water smartweed	3.24	0.33%
Beardgrass	0.42	0.04%
Curly dock	1.46	0.15%
Nutsedge/bulrush shoots	69.23	6.95%
Bulrush, tall	0.09	0.01%
Clover	0.36	0.04%
Cattail	0.28	0.03%
Cocklebur	0.89	0.09%
Total Vegetative Cover	115.99	11.65%
Total Length of Transects	995.5	

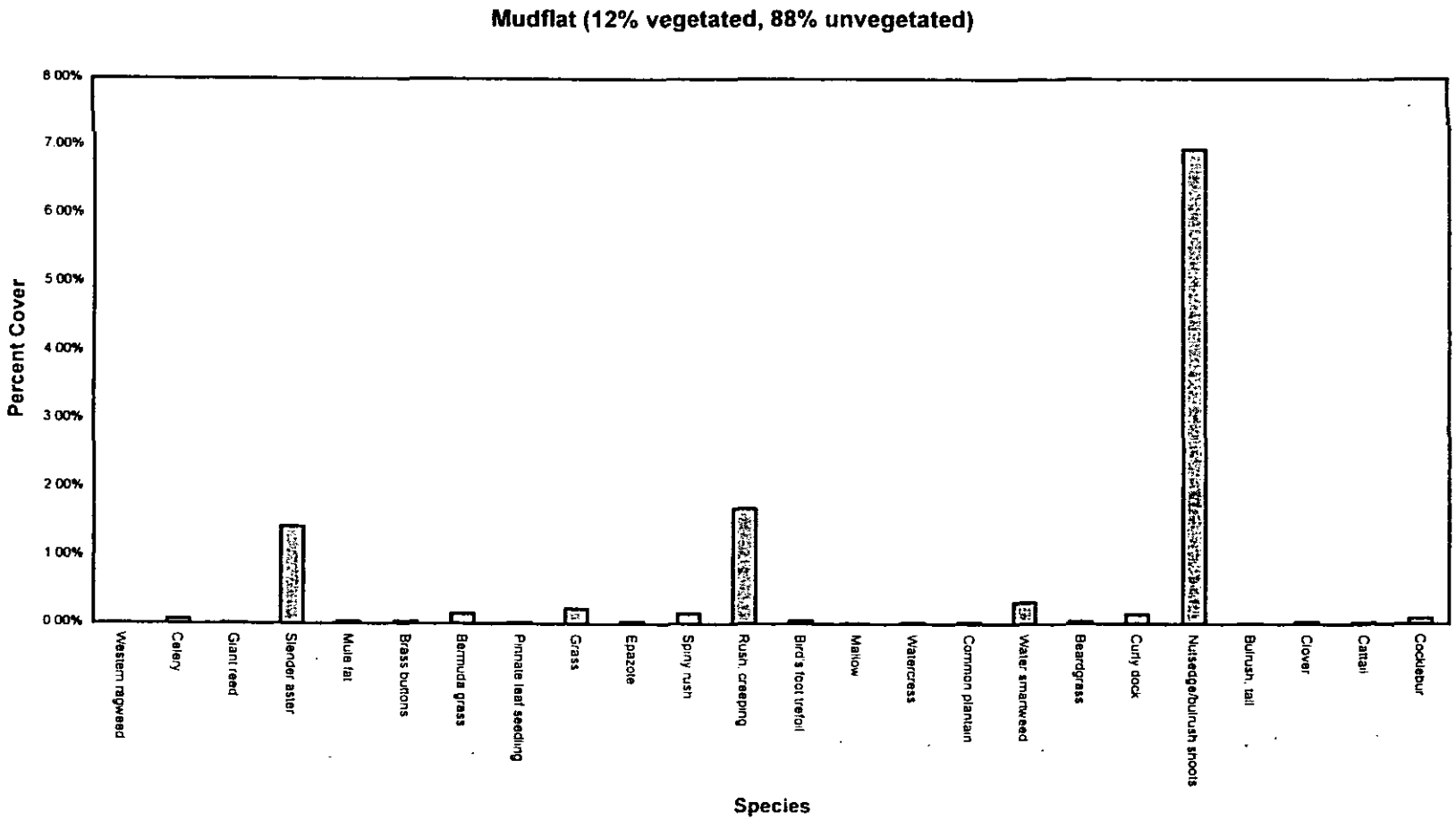


Figure 3-9. Relative Abundance of Tidal Mudflat Vegetation Species.

3.3.4 North Side of Estuary

The northern side of the estuary has a dense band of willows along the upper side of the levees. A considerable expanse of giant reed lies between the willows and the open water, although bulrush stands are present along portions of the northern side. Patches of other species are occasional in this area, including saltgrass, epazote (*Chenopodium ambrosioides*) and marsh fleabane (*Pluchea odorata*). An area of giant reed and pampas grass at the northwest end of the estuary had been burned. However, the giant reed was re-sprouting in June and was over six feet high in September.

3.3.5 Special-Status Species

The special-status species, salt marsh bird's beak (*Cordylanthus maritimus* ssp. *maritimus*), formerly present in the marsh in the area recently removed by the river (T. Munro, pers. comm.). No individuals of this genus were observed during March, June, or September 1999.

3.4 AVIAN SURVEY RESULTS

A total of 89 and 56 species were recorded during the March and June 1999 surveys, respectively. Table 3-9 presents a complete list of all observed species. These species were recorded in four major habitats, including: 1) the open water/mudflats of the Santa Clara River Estuary; 2) emergent marsh habitat bordering the southern end of the estuary; 3) riparian habitat adjacent to the southeastern portion of the estuary; and 4) the beach/nearshore waters just west of the estuary. The survey results are presented in Tables 3-10 – 3-13.

3.4.1 OPEN WATER/MUDFLAT HABITAT OF THE SANTA CLARA RIVER ESTUARY

Winter

The avifauna inhabiting the Estuary during winter was characterized by a mixture of species that utilize fresh, brackish and salt water habitats. The predominant species were species, such as shorebirds and gulls that are commonly found in marine environments during winter along the coast of California (Table 3-10). Shorebirds such as the western sandpiper, least sandpiper, sanderling and America Avocet were observed foraging during both low and high tides, however, the greatest concentration was recorded during low tide when more feeding areas were exposed. California brown pelicans were fairly abundant during both low and high tide surveys, when they would roost at the river mouth or bathe in the waters of the estuary. Gulls were often observed in large rafts on the open water of the Estuary or resting on the sand spit at the western side of the estuary.

There were a number of observed species that typically prefer brackish to fresh water habitats, however, they do also frequent estuarine systems during winter. These species included the great blue heron, snowy egret, green-winged teal, cinnamon teal, mallard, northern shoveler, and gadwall.

Spring

During the spring surveys there was a marked decline of all waterbirds, as most species migrate north to their breeding grounds (Table 3-10). During the winter surveys, greater than 2000 individual birds were recorded, representing a maximum of 27 species. In contrast, the recorded abundance in spring declined to less than 200 individuals, with a maximum species diversity of 17 species. This reduction in bird numbers in an estuary system is typical for California.

Of particular interest is the presence of the California Least Tern, a state and federal endangered species, that nests in a fenced preserve at the northern end of the estuary. Least terns were observed foraging in the estuary, however, most of the foraging appeared to be in the offshore waters. Additionally, the federally-threatened Snowy

Plover was observed and most likely nests in the Least Tern preserve as well as the surrounding area.

Forster's terns were fairly common, with most of their foraging occurring in the estuary and flooded portions of the marsh. Juvenile terns were observed resting on sandbars in the estuary, indicating that this species probably nests in the area. American avocets were recorded sitting on nests, and it is likely that black-necked stilts also nest in the area.

Species recorded during the spring survey but not during the winter surveys included the Wilson's and red-necked phalaropes, and black and ruddy turnstones. These species probably completed their nesting cycle and were en-route to their wintering grounds.

3.4.2 MARSH HABITAT

During the winter surveys, two 500m line transects were established to record the abundance and diversity of birds in this habitat. In contrast, during the spring surveys, the river mouth was closed which caused portions of the marsh to become flooded, thus preventing access. As such, direct counts were performed during spring.

Winter

During the winter surveys, the species diversity was low and was dominated by terrestrial species such as violet-green swallows, cliff swallows, yellow-rumped warblers (Table 3-11). The only waterbirds present were the mallard and common snipe. As the marsh area was only shallowly-flooded, it was not surprising that there was such a paucity of waterbirds.

Spring

In contrast, during the spring surveys there was a shift to a predominance of waterbirds. For example, mallards, cinnamon teal, gadwalls, and black-necked stilt were quite numerous. It is expected that all these species probably nest in this marsh area or nearby. Other species recorded during spring but not during winter included the pied-billed grebe, great egret, green heron, black-crowned night heron, white-faced ibis, ruddy duck, American coot, common gallinule and Forster's tern. No doubt, the presence of the water attracted these species to the area. Most of these species typically prefer fresh to brackish water.

3.4.3 BEACH/NEARSHORE HABITAT

The beach and nearshore habitats had the lowest species diversity and abundance of all the habitats (Table 3-12). Waterbirds preferred the estuary for feeding and roosting, as well as nesting by some species.

Winter

The dominant species recorded was the endangered California brown pelican. Approximately 567 individuals were recorded resting and preening at the river mouth. Also, the federally-threatened Snowy Plover was observed sleeping in depressions in the sand, most likely seeking protection from the wind. Bufflehead and ruddy ducks were observed foraging in a low-lying pond that probably filled during extremely high tides.

Spring

In spring, the numbers of waterbirds declined from 635 individuals to 37. The numbers of California brown pelicans greatly diminished, as most were probably on their nesting grounds at Anacapa. There was some shorebird activity, as these birds had probably already finished nesting on their northern breeding grounds (ruddy turnstone, black turnstone, and sanderling).

3.4.4 RIPARIAN HABITAT

The dominant vegetation in the riparian habitat was willows and cottonwoods, which are species characteristic of freshwater riparian systems. Large portions of the riparian habitat were flooded during spring as a result of the closed river mouth. Consequently, the number of point counts had to be reduced during the spring surveys.

Winter

The riparian habitat was characterized by both resident species and by winter/migrant visitors (Table 3-13). Species such as the white-throated swift, hermit thrush, fox sparrow and blue gray gnatcatcher are probably winter residents that do not breed in the area. In contrast, resident species and local breeders included the California towhee, spotted towhee, wrentit, Bewick's wren, and common yellowthroat. Early nesting species included an Allen's hummingbird, where a female was observed sitting on a nest, and the male was perched nearby.

Spring

Although the number of individuals was lower than the winter surveys, there were a number of summer breeders that were only recorded during this time period, such as the Swainson's thrush and black-headed grosbeak (Table 3-13). Resident species recorded during winter were also noted during the spring surveys.

Table 3-9. Avian Species Observed During March and June 1999 Surveys Conducted at the Santa Clara River Estuary in Ventura County, California

Common Name	Species	March, 1999	June, 1999
		Winter	Spring
Pied-billed Grebe	*Podiceps podiceps*	X	X
Eared Grebe	*Podiceps nigricollis*	X	
Western Grebe	*Aechmophorus occidentalis*	X	
Clark's Grebe	*Aechmophorus clarkii*	X	X
California Brown Pelican	*Pelecanus occidentalis californicus*	X	X
Double-crested Cormorant	*Phalacrocorax auritus*	X	
Brandt's Cormorant	*Phalacrocorax penicillatus*	X	
Black-crowned Night Heron	*Nycticorax nycticorax*		X
Green Heron	*Butorides striatus*		X
Great Blue Heron	*Ardea herodias*	X	X
Great Egret	*Ardea albus*	X	
Snowy Egret	*Egretta thula*	X	
Brant	*Branta bernicla*	X	
White-faced Ibis	*Plegadis chihi*		X
Green-winged Teal	*Anas crecca*	X	
Mallard	*Anas platyrhynchos*	X	X
Cinnamon Teal	*Anas cyanoptera*	X	X
Blue-winged Teal	*Anas discors*	X	
Northern Shoveler	*Anas clypeata*	X	
Gadwall	*Anas strepera*	X	X
American Widgeon	*Anas americana*	X	
Bufflehead	*Bucephala albeola*	X	
Ruddy Duck	*Oxyura jamaicensis*	X	X
American Coot	*Fulica americana*	X	X
American Avocet	*Recurvirostra americana*	X	X
Black-necked Stilt	*Himantopus mexicanus*		X
Black-bellied Plover	*Plubialis squatarola*	X	
Snowy plover	*Charadrius alexandrinus*	X	X
Long-billed Curlew	*Numenius americanus*		X
Greater Yellowlegs	*Tringa melanoleuca*	X	
Willet	*Catotrophorus semipalmatus*	X	
Sanderling	*Calidris alba*	X	
Western Sandpiper	*Calidris mauri*	X	X
Least Sandpiper	*Calidris miniutilla*	X	
Spotted Sandpiper	*Actitis macularia*		X

Common Name	Species	March, 1999	June, 1999
		Winter	Spring
Wilson's Phalarope	*Phalaropus tricolor*		X
Red-necked Phalarope	*Phalaropus lobatus*		X
Dunlin	*Calidris alpina*	X	X
Ruddy Turnstone	*Arenaria interpres*		X
Black Turnstone	*Arenaria melanocephala*		X
Long-billed Dowitcher	*Limodromus scolopaceus*	X	
Bonaparte's Gull	*Larus philadelphia*	X	
Heermann's Gull	*Larus heermanni*	X	X
Mew Gull	*Larus canus*	X	
Ring-billed Gull	*Larus delawarensis*	X	
Herring Gull	*Larus argentatus*	X	
California Gull	*Larus californicus*	X	X
Western Gull	*Larus occidentalis*	X	X
Caspian Tern	*Sterna caspia*	X	X
Forster's Tern	*Sterna forsteri*		X
Least Tern	*Sterna antillarum*		X
Great Egret	*Ardea albus*	X	
Snowy Egret	*Egretta thula*	X	
Turkey Vulture	*Cathartes aura*	X	
Northern Harrier	*Circus cyaneus*	X	
Killdeer	*Charadrius vociferous*	X	X
Common Snipe	*Capella gallinago*	X	
Rock Dove	*Columba livia*	X	
Mourning Dove	*Zenaida macroura*	X	
Allen's Hummingbird	*Selasphorus sasin*	X	
Anna's Hummingbird	*Calypte anna*	X	
White-throated Swift	*Aeronautes saxatalis*	X	
Belted Kingfisher	*Ceryle alcyon*	X	
Northern Flicker	*Colaptes auratus*	X	
Downy Woodpecker	*Picoides villosus*	X	X
Black Phoebe	*Sayornis nigricans*	X	X
Pacific-slope Flycatcher	*Empidonax difficilis*	X	
Western Kingbird	*Tyrannus verticalis*	X	
Tree Swallow	*Tachycineta bicolor*	X	X
Violet-green Swallow	*Tachycineta thalassina*	X	
Northern Rough-winged Swallow	*Stelgidopteryx ruficollis*	X	X
Cliff Swallow	*Hirundo pyrrhonota*	X	X
Barn Swallow	*Hirundo rustica*	X	X
Western Scrub Jay	*Aphelocoma coerulescens*	X	
American Crow	*Corvus brachyrayncnos*	X	

Common Name	Species	March, 1999	June, 1999
		Winter	Spring
Common Raven	*Corvus corax*	X	
Bushtit	*Psaltriparus minimus*	X	
Bewick's Wren	*Thryomanes bewickii*	X	X
Marsh Wren	*Cistothorus palustris*	X	
Ruby-crowned Kinglet	*Regulus calendula*	X	
Blue-gray Gnatcatcher	*Polioptila caerulea*	X	
Hermit Thrush	*Catharus ustulatus*	X	X
Swainson's Thrush	*Catharus ustulatus*		X
American Robin	*Turdus migratorius*	X	X
Wrentit	*Chamaea fasciata*	X	X
Northern Mockingbird	*Mimos polyglottos*	X	
California Thrasher	*Taxostoma redivivum*	X	
European Starling	*Sturnus vulgaris*	X	X
Orange-crowned Warbler	*Vermivora celata*	X	X
Yellow-rumped Warbler	*Dendroica coronata*	X	
Common Yellowthroat	*Geothlypis trichas*	X	X
Wilson's Warbler	*Wilsonia pusilla*	X	X
Black-headed Grosbeak	*Pheucticus melanocephalus*		X
Spotted Towhee	*Pipilo erythrophthalmus*	X	X
California Towhee	*Pipilo crissalis*	X	X
Song Sparrow	*Melospiza melodia*	X	
White-crowned Sparrow	*Zonotrichia leucophrys*	X	
Golden-crowned Sparrow	*Zonotrichia atricapilla*	X	
Fox Sparrow	*Passerella iliaca*	X	
Red-winged Blackbird	*Agelaius phoeniceus*	X	X
Brown-headed Cowbird	*Molothrus ater*		X
Hooded Oriole	*Icterus cucullatus*		X
American Goldfinch	*Carduelis tristis*		X
House Finch	*Carpodacus mexicanus*	X	X
Lesser Goldfinch	*Carduelis psaltria*	X	

Table 3-10. Summary of Waterbird Species and Numbers Recorded During March and June 1999 at the Santa Clara River Estuary in Ventura County, California

	March, 1999						June, 1999					
	Winter						Spring					
Common Name	Low Tide	Low Tide	Low Tide (Avg)	Low Tide Relative Abundance	High Tide	High Tide Relative Abundance	Low Tide	Low Tide Relative Abundance	High Tide	High Tide Relative Abundance	Northern Arm of Estuary	Northern Arm of Estuary - Relative Abundance
Pied-billed Grebe							1	.06				
California Brown Pelican	738	275	506.5	21.6	925	45.0	11	7.1	15	9.9		
Double-crested Cormorant							21	13.6	17	11.3		
Great Blue Heron		3	1.5	0.1		0.0	2	1.3	1	0.7		
Snowy Egret		1	0.5	0.0		0.0						
Green-winged Teal	17	73	45	1.9		0.0						
Cinnamon Teal	6	67	36.5	1.6		0.0						
Mallard		3	1.5	0.1		0.0	1	0.6				
Northern Shoveler	2	2	2	0.1		0.0						
Gadwall	147	90	118.5	5.1		0.0	6	3.9	3	2.0	2	2.3
Ruddy Duck							1	0.6	5	3.3		
American Coot	159	31	95	4.1	299	14.5	24	15.6	18	11.9		
American Avocet	62	49	55.5	2.4		0.0	8	5.2	1	0.7	2	2.3
Black-bellied Plover		1	0.5	0.0	3	0.1						
Black-necked Stilt							1	0.6			1	1.1
Snowy Plover			0	0.0	8	0.4					8	9.2

March, 1999							June, 1999					
Winter							Spring					
Common Name	Low Tide	Low Tide	Low Tide (Avg)	Low Tide Relative Abundance	High Tide	High Tide Relative Abundance	Low Tide	Low Tide Relative Abundance	High Tide	High Tide Relative Abundance	Northern Arm of Estuary	Northern Arm of Estuary - Relative Abundance
Killdeer		10	5	0.2	3	0.1	2	1.3	1	0.7	2	2.3
Greater Yellowlegs	2		1	0.0		0.0						
Willet		3	1.5	0.1	1	0.0						
Sanderling	163	26	94.5	4.0	17	0.8						
Western/Least Sandpipers		131	65.5	2.8	35	1.7						
Western Sandpiper		42	21	0.9		0.0						
Least Sandpiper		24	12	0.5		0.0						
Spotted Sandpiper							2	1.3				
Ruddy Turnstone							3	1.9			4	4.6
Sanderling											1	1.1
Western Sandpiper											2	2.3
Dunlin	2	1	1.5	0.1		0.0					1	1.1
Long-billed Dowitcher		1	0.5	0.0		0.0						
Red-necked Phalarope											2	2.3
Wilson's Phalarope											11	12.6
Heermann's Gull	1	5	3	0.1	6	0.3					1	1.1
Bonaparte's Gull		5	2.5	0.1	4	0.2						
Mew Gull	54	112	83	3.5	125	6.1						
Ring-billed Gull	70	29	49.5	2.1	31	1.5						
California Gull		55	27.5	1.2	75	3.6					2	2.3

March, 1999							June, 1999					
Winter							Spring					
Common Name	Low Tide	Low Tide	Low Tide (Avg)	Low Tide Relative Abundance	High Tide	High Tide Relative Abundance	Low Tide	Low Tide Relative Abundance	High Tide	High Tide Relative Abundance	Northern Arm of Estuary	Northern Arm of Estuary - Relative Abundance
Western Gull	230	137	183.5	7.8	110	5.3					26	29.9
Gull spp.	1134	720	927	39.6	414	20.1					14	16.1
Caspian Tern		1	0.5	0.0	1	0.0	1	0.6	3	2.0		
Least Tern							1	0.6	3	2.0	1	1.1
Forster's Tern							19	12.3	17	11.3	7	8.0
Total No. of Individuals	2787	1897	2342	100.0	2057	100.0	154	100.0	151	100.0	87.0	100.0
Total No. of Species	15	27	21		16		17		12		17	

Table 3-11. Total Number and Relative Abundance of Birds Recorded During March 1999 on Line Transects and in June 1999 During Direct Counts in Emergent Marsh Habitat Adjacent to the Santa Clara River Estuary.

Common Name	March 1999 Line Transect M1	March 1999 Line Transect M1 - Relative	March 1999 Line Transect M2	March 1999 Line Transect M2 - Relative	June 1999 Direct Count	June 1999 Direct Count - Relative Abundance
Pied-billed Grebe					2	1.0
Great Egret					4	2.1
Green Heron					1	0.5
Black-crowned Night Heron					1	0.5
White-faced Ibis					1	0.5
Mallard	2	3.3			33	16.9
Cinnamon Teal					6	3.1
Gadwall					6	3.1
Ruddy Duck					1	0.5
American Coot					2	1.0
Common Gallinule					1	0.5
Killdeer					2	1.0
Black-necked Stilt					13	6.7
Common Snipe			2	2.5		
Fosters Tern					2	1.0
Tree Swallow			3	3.8	2	1.0
Violet-green Swallow	8	13.3	52	65.8		
Cliff Swallow			3	3.8	100	51.3
Barn Swallow			1	1.3	3	1.5
Northern Rough-winged Swallow					8	4.1
Marsh Wren			3	3.8		
American Robin						
California Thrasher			1	1.3		
Yellow-rumped Warbler			7	8.9		
Common Yellowthroat	6	10.0	1	1.3	3	1.5
California Towhee			1	1.3		
Song Sparrow			3	3.8	4	2.1
Red-winged Blackbird			2	2.5		
House Finch	44	73.3				
Total Number of Individuals	60	100.0	79	100	195	100.0
Total Number of Species	9		12		20	

Table 3-12. Total Number and Relative Abundance of Birds Recorded During March and June 1999 on Line Transects Along Beach and Offshore Habitats Adjacent to the Santa Clara River Estuary.

	March, 1999		June, 1999	
	Winter		Spring	
Common Name	Beach/Offshore Line Transect	Beach/Offshore Line Transect Line Transect - Relative Abundance (%)	Beach/Offshore Line Transect	Beach/Offshore Line Transect Line Transect - Relative Abundance (%)
Pied-billed Grebe	1	0.2		
Western Grebe	1	0.2		
California Brown Pelican	567	89.3	6	16.2
Double-crested Cormorant	2	0.3	2	5.4
Mallard	2	0.3		
Bufflehead	7	1.1		
Ruddy Duck	8	1.3		
Snowy plover	28	4.4	1	2.7
Amercian Avocet			2	5.4
Long-billed Curlew			1	2.7
Ruddy turnstone			6	16.2
Sanderling			13	35.1
Western Sandpiper			1	2.7
Least Tern			5	13.5
Shorebird sp.	1	0.2		
Western Gull	18	2.8		
Violet-green Swallow	2	0.3		
Total Number of Individuals	635	100	37	100
Total Number of Species	11		9	

Table 3-13. Total Number and Relative Abundance of Birds Recorded During March and June 1999 at Point Count Stations in Riparian Habitat Adjacent to the Santa Clara River Estuary.

		March, 1999	June, 1999	
		Winter	Spring	
Common Name	Total No.	Relative Abundance (%)	Total No.	Relative Abundance (%)
Mourning Dove	5	3	11	12
Allen's Hummingbird	6	4	0	0
Anna's Hummingbird	7	4	0	0
Hummingbird sp.	2	1	2	2
White-throated Swift	4	2	0	0
Belted Kingfisher	1	1	0	0
Downy Woodpecker	1	1	1	1
Passerine sp.	1	1	0	0
Pacific-slope Flycatcher	1	1	0	0
Violet-green Swallow	3	2	0	0
Cliff Swallow	0	0	11	12
American Crow	4	2	0	0
Bushtit	28	17	4	4
Bewick's Wren	7	4	3	3
Blue-gray Gnatcatcher	3	2	0	0
Hemit Thrush	6	4	0	0
Swainson's Thrush	0	0	3	3
Wrentit	2	1	7	8
European Starling	0	0	12	13
California Thrasher	4	2	0	0
Orange-crowned Warbler	6	4	6	6
Yellow-rumped Warbler	13	8	0	0
Common Yellowthroat	10	6	1	1
Wilson's Warbler	2	1	2	2
Black-headed Grosbeak	0	0	3	3
Spotted Towhee	7	4	6	6
California Towhee	8	5	6	6
Red-winged Blackbird	0	0	1	1
Brown-headed Cowbird	0	0	3	3
Song Sparrow	5	3	8	9
Fox Sparrow	2	1	0	0
House Finch	21	13	2	2

		March, 1999	June, 1999	
		Winter	Spring	
Common Name	Total No.	Relative Abundance (%)	Total No.	Relative Abundance (%)
Lesser Goldfinch	2	1	0	0
American Goldfinch	0	0	1	1
Total Number of Individuals	161	100	93	100
Total Number of Species	27		15	

[1] Total number of individuals is based on surveying each point count station once.

3.5 WILDLIFE SURVEYS

3.5.1 MAMMAL SURVEYS

Few mammal species were observed during the reconnaissance level surveys. The two dominant species were the Audubon's cottontail and California ground squirrel. The cottontails were abundant in the riparian habitat, as well as the campground. California ground squirrels were also numerous in the campground and along the levee bordering the riparian and marsh habitats.

There were numerous rodent holes on this levee. The size of the entrance holes ranged from 2-8cm. It is believed that these burrows represented two species in the Heteromyidae Family, which consists of kangaroo rats, kangaroo mice and pocket mice. Scats of raccoons containing very coarse hair were near these burrows, suggesting that raccoons were preying on kangaroo rats and/or pocket mice. Also, numerous scats of raccoons were scattered throughout the riparian habitats. A road-killed striped skunk was also found adjacent to the riparian habitat.

A bobcat was observed early in the morning in the riparian area adjacent to the campground. Racoon tracks and bobcat tracks were seen under the Harbor Boulevard bridge and in the upstream areas of the Estuary.

3.5.2 AMPHIBIAN AND REPTILE SURVEYS

The most common reptile was the western fence lizard, which was found in the riparian area under willow branches. A juvenile king snake was also found in a grassy patch, indicating that this species breeds in the area. Numerous Pacific treefrogs were heard vocalizing in the riparian area, and tadpoles were founded in the flooded portions of the trail in the riparian survey area.

3.6 AQUATIC SURVEY

3.6.1 FISH AND WATER COLUMN COMMUNITY

Winter

Seine sampling results are presented in Table 3-14. During the Winter surveys, no fish were collected at the "mouth" station and only one of the four "bridge" station replicates contained fish. Federally endangered tidewater gobies were found at both the "outfall" and the "backwater" stations, in areas of high vegetation. Many mosquito fish were captured and observed in an area of flooded watercress at the bridge station. A few were also captured at the backwater station. Striped mullet were collected at the outfall station. Water boatmen (*Corixidae*), common in saltmarshes, and gammarid amphipods were collected at all stations. (Table 3-14).

Spring

In the Spring surveys, tidewater gobies, African Clawed Frog Tadpoles and Fathead Minnow were captured at all sampling stations as were Water boatmen (*Corixidae*) and *Gammarid* amphipods. Arroyo chub were collected at the Backwater and Bridge stations. Mosquito fish and Green Sunfish were collected at the outfall and backwater stations and Pacific Treefrog tadpoles were collected at the outfall station. Large amounts of the freshwater waterfleas (*Daphia sp.*) were collected at the mouth station. Least Terns and Forster's Terns were actively foraging for and capturing unidentified fish species in the deeper waters of the Estuary. Aquatic snails of the genus *Physa* (alive and shells) were collected at all stations.

Tidewater gobies were most abundant at the bridge and backwater stations. Consistent with their life history, when they are found, gobies are generally found in high numbers (R. Swenson, pers. comm.). Most of the tidewater gobies collected were small (20-35mm) indicating that the gobies are using the Estuary for reproduction and rearing.

Summer

Tidewater gobies were the predominant fish species captured in the Summer survey. This species was seined in abundance at three of the four sampling stations and found in lower abundances at the Bridge station (Station 3). Most were in the 30-45 mm length category indicating that the younger fish observed in the Spring survey are rearing to adulthood in the Estuary. Relatively few mosquito fish were collected at the mouth, and backwater stations, although there were a good number at the bridge station. Arroyo Chub and Fathead minnows were collected at the outfall station (Station 2) and the bridge station. A school of several hundred Arroyo Chub were observed in a pool adjacent to the bridge abutment; 500-600 were collected, most of these were young of the year.

Approximately 50 newly transformed, young adult African Clawed Frogs were collected in heavy vegetation on the north bank of the river upstream from the bridge. Two crawdads were also collected at this location.

Noteably absent from the Summer survey were the Green Sunfish and the gammarid amphipods. Gammarid populations fluctuate seasonally (G. Greenwald, pers. comm.). The absence of the Green Sunfish may be due to the fact that the Estuary had been open to the ocean since July. This is supported by the collection of three California KilliFish (*Fundulus parvipinnis*). This is the only truly estuarine species collected in the surveys (C. Swift, pers. comm.). Historically Killifish co-occur with tidewater gobies. The three individuals were small and likely newly emerged. It is likely adult Killifish entered the Estuary from the ocean and spawned in the Estuary. This species is known to occur in Malibu Lagoon, the Ventura River Estuary, Carpinteria Marsh and the Goleta Slough (C. Swift, pers. comm.). They can tolerate a wide range of salinities and have become established in freshwater streams (Moyle, 1976).

Table 3-14. Seine Sampling Results: March, June and September 1999 Santa Clara River Estuary

		March, 1999 (Winter)				June, 1999 (Spring)				September, 1999 (Summer)			
Common Name	Species Name	1 mouth	2 outfall	3 bridge	4 backwater	1 mouth	2 outfall	3 bridge	4 backwater	1 mouth	2 outfall	3 bridge	4 backwater
Tidewater goby	*Eucyclogobius newberryi*	0	3	0	6	23	293	3000+	700+	113	130	22	92
Arroyo chub	*Gila orcutti*	0	24	0	1	0	0	15	19	2	44	600	0
Mosquito fish	*Gambusia affinis*	0	0	14	3	0	1	0	6	1	0	100	5
California Killifish	*Fundulus parvipinnis*	0	0	0	0	0	0	0	0	2	0	0	1
Striped mullet	*Mugil cephalus*	0	2	0	0	0	0	0	0	0	0	0	0
Green Sunfish	*Lepomis cyanellus*	0	0	0	0	0	6	0	29	0	0	0	0
Fathead Minnow	*Pimephales promelas*	0	0	0	0	5	8	15	3	0	15	65	0
African Clawed Frog adults	*Xenopus laevis*	0	0	0	0	0	0	0	0	0	0	50	0
African Calwed Frog tadpoles	*Xenopus laevis*	0	0	0	0	40	19	1000+	24	0	0	0	0
Pacific Tree Frog tadpole	*Hyla regilla*	0	0	0	0	0	7	0	0	0	0	0	0
Insects & larvae	Corixidae	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N
	Belastomid	N	N	N	Y	N	N	N	N	N	N	N	N
	Chironomidae larvae	Y	N	N	N	N	N	N	N	N	N	N	N
	Coleoptera	N	N	N	Y	N	N	N	N	N	N	N	N
	Dragonfly larvae	N	N	N	N	N	N	N	Y	N	N	N	N
Crustaceans	*Gammarid amphipod*	Y	Y	Y	Y	Y	Y	Y	Y	0	0	0	0
	Daphnia sp.	N	N	N	N	Y	N	N	N	0	0	0	0
	Crawdad	0	0	0	0	0	0	0	0	0	0	2	0
River Snails	*Physa sp.*	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y

3.6.2 BENTHIC COMMUNITY RESULTS

Table 3-15 presents a list of the benthic invertebrates and infauna sampled during the three aquatic surveys in March, June and September 1999. Table 3-16 provides species abundance at each sampling station for each survey and an indication as to whether the species is primarily a freshwater organism.

Overall the invertebrate infauna, and seined invertebrates, in the samples collected during the three aquatic surveys may be characterized as freshwater species. The only definitely marine speices is the polychaete *Cossura candida*. Only one individual was collected at the mouth station.

Insects included such typical freswater forms as dragonfly and damselfly nymphs, mayfly nymphs, water bugs, and non-saltmarsh varieties of water boatmen. Midge larvae and pupae contributed to the majority of the invertebrate biomass in the benthic samples. This is consistent with the findings of the on-going DPR/USFWS survey of the Estuary (G. Greenwald, pers. comm.). No larvae of the marine midge, *Telmatogeton maswaini*, were found. Dolichopodids (long-legged flies) occur in moist areas, especially along the margins of ponds or creeks. A few species have aquatic larvae. Springtails (Collembola) are minute and are found on the waer's surface. Two parasitic braconid wasps were collected in the Spring sample. These wasps may seek hosts from among the aquatic insects.

The Oligochaeta are more difficult to definitely document as freshwater forms, owing to the lack of study of these taxa along the Southern California Coast. Most of the Pacific Coast freshwater oligochaete work by the noted authority R.O. Brinkhurst has focused on the British Columbia/Washington State area. In general, however, oligochaetes are the dominant annelids in freshwater habitats (Morris, et al, 1980). The oligochaetes in the samples did not resemble typical marine forms found in the local area. The highest abundance of oligochaetes were collected in the outfall channel, the bridge and the back channel stations, all areas of typically fresh water, even when the river mouth is open to the ocean. Based on the associated fauna and the salinity regime of the Estuary, it is likely these are freshwater species.

The Ostracods are members of the family Cyprinidae. Although there are marine forms of this family, it is very common in freshwater (Morris, et al, 1980). Ostracods dwell on the bottom, browsing among the sediment grains for food particles. As with the oligochaetes, the species collected did not resemble local marine species and the greatest abundance were found in the outfall channel (a consistent freshwater source). These are assumed to be freshwater species.

River snails, from the genus *Physa*, were collected in both the benthic samples and in abundance in the seine samples. Their distribution is widespread throughout the Estuary, although their abundance may be seasonal.

Table 3-15. Benthic Infauna Species List

- ANNELIDA
  - Polychaeta
    - Cossuridae
      - *Cossura candida*
  - Oligochaeta
    - Enchytraeidae sp 1
    - Enehytraeidae sp 2
    - Naididae sp 1
    - Tubificidae sp 1
- MOLLUSCA
  - Gastropoda
    - Pulmonata
    - Physidae
      - *Physa sp*
    - Planorbidae
- ARTHROPODA
  - Crustacea
    - Cladocera
      - *Daphnia sp*
    - Copepoda
      - Cyclopoidea
    - Ostracoda
      - Cyprinidae sp 1
      - Ostracod sp 2
      - Ostracod sp 3
    - Amphipoda
      - Gammaridae
        - *Gammarus sp*
      - Hyalidae
        - *Hyalella sp*
- INSECTA
  - Collembola
    - Isotomidae
  - Ephemeroptera
  - Hymenoptera
    - Formicidae (ant – terrestrial organism)
    - Braconidae
      - *Apanteles sp*
    - Corixidae
      - *Hesperocorixa laevigata*
    - Diptera
      - Nematocera
        - Ceratopogonidae
          - *Chironomus sp*
        - Chironomidae sp 1
        - Chironomidae sp 2
      - Brachycera
        - Dolichopodidae
          - *Hydrophorus sp*
        - Ephydridae
        - Muscidae

Table 3-16. Benthic Infauna Sampling Results.

				March, 1999 Station				June, 1999 Station				September, 1999 Station			
Category	Common Name	Latin Name	Primarily Freshwater	# 1 River Mouth	# 2 Outfall Channel	# 3 Bridge	# 4 Back Channel	# 1 River Mouth	# 2 Outfall Channel	# 3 Bridge	# 4 Back Channel	# 1 River Mouth	# 2 Outfall Channel	# 3 Bridge	# 4 Back Channel
Annelid	None	Oligochacta/Tubificidae sp 1	Y	4	112	100	230	7	2	138	0	0	0	3	2
	None	Oligochacta/Enchytraeidae sp 1	Y	0	7	0	3	0	2	0	0	0	0	0	0
	None	Oligochacta/Enchytraeidae sp 2	Y	0	0	0	0	0	2	0	0	0	0	0	0
	None	Oligochacta/Enchytraeidae	Y	0	0	0	0	0	0	0	10	0	0	0	0
	Round Worm	Nematoda/Naididae sp 1	Y	0	0	0	0	0	0	1	0	0	0	1	0
	None	Polychaeta/Cossura Candida	N	0	0	0	0	1	0	0	0	0	0	0	0
Insecta	Mayfly nymph	Ephemeroptera	Y	2	0	0	0	0	0	0	0	0	0	0	0
	Damselfly molted exoskeletons	Odonata	Y	2	0	0	0	0	0	0	0	0	0	0	0
	Larvae *(midge)*	Diptera/Chironomidae	Y	0	0	0	0	38	29	166	59	0	0	0	0
	Larvae (midge)	Diptera/Chironomidae sp 1	Y	2	2	6	0	117	3	9	0	0	4	0	0
	Larvae (midge)	Diptera/Chironomidae sp 2	Y	0	0	0	0	0	0	7	2	0	0	13	0
	Pupae (midge)	Diptera/Chironomidae sp	Y	0	0	0	0	0	0	0	13	0	0	0	0
	Pupae (midge)	Diptera/Chironomidae	Y	0	0	5	0	16	1	4	1	0	0	0	0
	Midge	Diptera/Chironomidae	Y	0	0	0	0	2	0	1	0	0	0	0	0
	Pupae (long-legged fly)	Diptera/Dolichopodidae	Y	1	0	0	0	0	0	0	0	1	1	0	1
	Larva	Diptera	?	0	0	0	0	0	1	0	0	0	0	0	0
	Springtail	Collembola/Isotomidae	Y	0	0	0	0	0	4	0	0	0	0	0	0
	Larvae (long-legged fly)	Diptera/Dolichopodidae	Y	0	0	1	0	0	0	1	0	0	0	0	0
	Mayfly larva (posterior fragment)	Ephemeroptera	Y	0	0	0	1	0	0	0	0	0	0	0	0
	Parasitic wasp[1]	*Hymenoptera/Braconidae*	*N*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*1*	*0*	*0*	0	0

				March, 1999 Station				June, 1999 Station				September, 1999 Station			
Category	Common Name	Latin Name	Primarily Freshwater	# 1 River Mouth	# 2 Outfall Channel	# 3 Bridge	# 4 Back Channel	# 1 River Mouth	# 2 Outfall Channel	# 3 Bridge	# 4 Back Channel	# 1 River Mouth	# 2 Outfall Channel	# 3 Bridge	# 4 Back Channel
Insecta Cont'd	Ant[2]	Formicidae/Hymenoptera	N	1	0	0	0	0	0	0	0	0	0	0	0
	Larvae (punkie?)	Diptera/Ceratopogonidae?	Y	0	0	0	3	0	0	0	0	0	0	0	0
	Gnat	Diptera/Nematocera	Y	0	0	0	0	0	1	0	0	0	0	0	0
	Shore fly puparium	Ephydridae	Y	0	0	0	0	0	0	0	0	1	0	0	0
	Fly puparium?	Diptera/Muscidae	?	0	0	0	0	0	0	0	1	0	0	0	0
Crustacea	Seed shrimp	Ostracoda/Cyprinidae sp 1	Y	0	127	0	1	0	11	0	14	2	19	0	8
	Seed shrimp	Ostracoda/Ostracoda sp 2	Y	0	0	0	6	0	0	0	0	0	0	22[3]	0[4]
	Seed shrimp	Ostracoda/Ostracoda sp 3	Y	0	0	0	1	0	0	2	0	0	0	0	1
	Seed shrimp	Ostracoda/Cyprinidae sp	Y	0	0	0	0	16	0	0	2	0	0	0	0
	Copepod	Copepoda/Cyclopoida	Y	0	0	0	0	3	0	10	2	0	0	0	0
	Scud	Amphipoda/Gammarus sp 1	Y	0	0	0	0	1	0	0	0	0	0	4	0
	Water flea	Cladocera/Daphnia sp	Y	0	0	0	0	0	2	0	0	0	0	0	0
Mollusca	River snail	Gastropoda/Physa sp	Y	0	0	0	0	0	0	5	3	0	0	3[5]	1[6]

Notes:
1. Wasps may find hosts in freshwater insects
2. Terrestrial organism
3. Dead shells found – not included in count
4. Only dead shells found
5. Dead shells found – not included in count
6. Dead shell

3.7 BIOACCUMULATION STUDY

As described in the methods Section 2.7, a bioaccumulation study was initiated in September 1999 using the State Mussel Watch Program protocols. Freshwater clams will be collected at 30, 60 and 90-day intervals. Samples that survive the longest in the Estuary will be analyzed for tissue concentrations of the metals COCs. This study is expected to conclude in December 1999 with test results available in January 2000.

The purpose of this study is to determine the appropriate standards for calculating water quality objectives for the Santa Clara River Estuary. In doing so, we examined the impacts of the Facility's discharge to the biota in the Estuary, evaluating the level of use of the designated beneficial uses. We assessed the aquatic biological communities and the water quality to determine if it is appropriate to apply freshwater and hardness correction factors to the calculations of the NPDES discharge limits for metals. We reviewed human health exposure levels to the contaminants of concern in the Estuary to determine if adjustments to the NPDES discharge limits for the two organics of concern would be appropriate. Finally, although we are not seeking site-specific objectives, as a conservative and protective measure, we reviewed the criteria for determining site-specific objectives to ensure protection of the designated beneficial uses.

The results of this study show the following:

1. Most of the designated beneficial uses are supported and enhanced by the Facility's discharge. In addition, the discharge provides make-up low from upstream water diversion and pumping, thus providing additional habitat for a number of threatened and endangered species of bird and fish.

2. The Estuary is primarily a freshwater ecosystem, which allows consideration of water hardness in recalculating NPDES discharge limits for metals.

3. The Estuary is a Natural Preserve and it is within the ESU for Southern Steelhead. As such, state regulations prohibit fishing and shellfish collection in the Estuary. Additionally, ENTRIX's bioassessment surveys and ongoing FWS surveys show that low numbers of suitably sized gamefish and edible shellfish inhabit the Estuary. Therefore, human consumption of the seafood in the Estuary is much lower than assumed in standard risk models. We propose that it is appropriate to consider site-specific data in calculating water quality objectives for the two organic constituents. Existing regulations and the lack of game species suggest that a consumption rate of zero would be appropriate. This report recommends that the use of a consumption rate equal to half the EPA value would still be conservatively protective of the COMM beneficial use. Adjusting the permit limits by incorporating site-specific information will be protective of the beneficial uses of the Estuary.

4. Adjusting the permit limits by incorporating site-specific information will not impair or harm the beneficial uses of the Estuary.

5. The criteria for determining the site specific objectives are met.

6. Monitoring studies of the Santa Clara River and Estuary show that ambient concentrations of the six constituents are comparable to the concentrations found in the effluent. Effluent concentrations and ambient concentrations exceed the NPDES limits with similar frequency for all constituents but copper. The following sections apply the data reported in Section 3.0 (Results) to each of these findings.

4.1 BENEFICIAL USES ARE SUPPORTED BY THE DISCHARGE

The State Water Quality Control Plan (Basin Plan) lists the following beneficial uses for the Estuary:

- Navigation
- Water Contact Recreation
- Non-contact Water Recreation
- Commercial and Sport Fishing
- Estuarine Habitat
- Marine Habitat
- Wildlife Habitat
- Rare, Threatened or Endangered species
- Migration of Aquatic Organisms
- Spawning, Reproduction and/or Early Development of fish

Each of these beneficial uses are supported and in some cases, enchanced by the Facility's discharge. The sections below provide a detailed description of these uses.

4.1.1 WILDLIFE AND HABITAT

The Estuary supports a wide diversity of avian wildlife, including a number of rare, endangered and threatened species. Among these include the Brown Pelican, Western Snowy Plover and California Least Tern. It provides a wintering ground and flyway for migrating birds, many of which were seen in this survey and have been documented in on-going surveys by the Point Reyes Bird Observatory. The Estuary is an ecosystem that is becoming rarer in Southern California where urban development is impacting the river and wetland systems that remain. Discharge from the City's outfall increases the water in this system, thereby increasing the habitat for this avian community.

As a river that supports federally endangered Southern California Steelhead, the Estuary is a critical waterway for migrating steelhead. Although we did not observe any steelhead during our surveys, on March 16th, an adult, female steelhead was captured at the Vern Freeman Diversion. Under direction of the National Marine Fisheries Service (NMFS), United Water Conservation District rescues (traps and transports) downstream migrating rainbow trout/steelhead smolts captured in the Vern Freeman Diversion. These fish are released in the Santa Clara River Estuary when the river beneath the diversion to the ocean is not contiguous (ENTRIX, 1996, pers. comm. 1999). Treated effluent from the City's facility augments water in the lagoon for these rescue efforts, especially during years of low flow.

Tidewater gobies have been collected throughout the Estuary. Bi-monthly surveys conducted by US Fish and Wildlife Service (USFWS) over the past two years report large numbers of gobies in the Estuary. The Estuary and surrounding marsh and riparian vegetation also supports the federally listed two-striped garter snake and South Coast garter snake. The South Coast garter snake is near extinction and is found in only two

other locations outside the Santa Clara River. California red-legged frogs are likely to occur in the Estuary, although they have not been documented.

4.1.2 Non-contact Water Recreation

During the three surveys, biologists noticed a number of people walking and visiting the beach and areas in and around the Estuary. Activities included walking/jogging, bird watching, beach combing and camping. The City of San Buenaventura leads guided field trips to the Estuary for local public elementary schools. A trained naturalist provides binoculars, bird guides and lessons on the ecology of the Estuary.

4.1.3 Water Contact Recreation

Although the campground had a number of campers, we did not observe any wading or swimming in the Estuary during our surveys. During the Summer survey when most swimming could be expected, the sandbar was breached and water levels were insufficient for swimming. Motorized water craft (e.g. water skiing, boating, personal watercraft) are prohibited in the 160 acre State Nature Preserve which includes the Estuary. It is our observation that the Estuary (and lagoon when the sandbar is not breached) is generally too shallow and turbid for SCUBA/skin diving.

4.1.4 Commercial and Sport Fishing

Commercial fishing and shellfish harvesting are prohibited in the Nature Preserve. DFG regulations prohibit recreational fishing in the Santa Clara River downstream of the Highway 23 bridge in Fillmore. During our surveys we observed no fishing or shellfish harvesting on the beach adjacent to the Estuary.

4.1.5 Navigation

It is our observation that the Estuary and the Santa Clara River are generally too shallow for navigation. Motorized watercraft and boats are prohibited in the State Nature Preserve.

4.1.6 Additional Benefits of the Discharge

In addition to supporting the designated beneficial uses, the consistent, perennial freshwater provided to the Estuary by the Facility's discharge has benefits to the biological communities and ecology of the Estuary. These benefits are summarized below.

Vegetation

The freshwater input from the Facilty is essential to maintaining a perennial freshwater environment and habitat. Reduction in freshwater flow would likely cause a shift to more saline conditions. The already limited area of riparian forest near the discharge channel on the north bank of the Estuary would likely retreat further upstream.

The riparian forest and salt marsh areas of the Estuary comprise what remains of the historic Santa Clara River Estuary. Reduction in the Facility's discharge could result in colonization by exotic species. The rare salt marsh bird's beak, which has been observed in the Estuary, is locally known to respond favorably to fresher water.

If fresh water eventually causes the salt marsh to transition to more brackish or freshwater conditions (i.e., soil salinity is diminished), the resulting vegetative composition would not necessarily be detrimental. The salt marsh acreage would likely become a freshwater-emergent wetland, which would not constitute a net loss.

Because southern California estuaries typically dry out more than more northern estuaries, marshes in southern California estuaries frequently develop a bare zone of soils too saline to support any vegetation (Barbour and Major 1988). No such area was present in the marsh on the south side of the Santa Clara River estuary. The influx of water from the treatment plant may contribute to a more extensive stand of marsh vegetation than would otherwise occur under present conditions. This again provides additional habitat for terrestrial fauna.

Discharge of water from the treatment plant maintains the estuary at a higher level over a longer period of time than would otherwise occur under present conditions. This benefit increases the size of the estuary, providing additional habitat for terrestrial wildlife and birds. This may also help to prevent the expansion of giant reed across the entire estuary. Giant reed was not present in the channels and was uncommon in the recently inundated portions of the estuary. The giant reed is an introduced species commonly found in Southern California streams and marshes. This plant is an aggressive invader which eliminates several native species.

The inundation of the marsh area may be facilitating the extension of marsh vegetation into transitional upland areas at the edges. Additionally, if inundation of the marsh is more frequent and extensive now that the levee has been partially removed, the apparent incursion of upland and transitional species into the central marsh areas may be reduced.

Wildlife and Avian Communities

The Estuary and Mugu Lagoon to the south, are the most important estuarine habitats for migrating birds in Ventura and Santa Barbara Counties. Many species fly over potential locations in San Diego and Santa Monica Bays to reach these two preferred locations. As such, the estuary provides important feeding, resting and nesting habitat for waterbirds. For example, during winter, shorebirds such as the western sandpiper, least sandpiper, sanderling and America Avocet were observed foraging during both low and high tides, however, the greatest concentration was recorded during low tide when more feeding areas were exposed. California brown pelicans were fairly abundant during both low and high tide surveys, when they would roost at the river mouth or bathe in the waters of the estuary. Gulls were often observed in large rafts on the open water of the Estuary or resting on the sand spit at the western side of the estuary.

During Spring, the California Least Tern and Western Snowy Plovers nest adjacent to the Estuary and forage within the estuary. Other likely nesting species include the Forster's terns, American avocets and black-necked stilts. The adjacent marsh also provided foraging and nesting habitat for a broad range of waterbirds, such as mallards, cinnamon teals, gadwalls, and black-necked stilts. The flooded marsh area during spring also attracted a variety of species typical of fresh and brackish marshes including the pied-billed grebe, great egret, green heron, black-crowned night heron, white-faced ibis, ruddy duck, American coot, common gallinule and Forster's tern. No doubt, the presence of the water attracted these species to the area.

In conclusion, there is no apparent impact to wildlife resources in estuary or the surrounding habitat as a result of the discharge of tertiary treated wastewater. This is evidenced by the high diversity and usage that these habitats receive, which provides a variety of beneficial uses for wildlife resources, such as feeding, nesting and roosting habitats. When the river mouth is open, it is unlikely that the waste water contributes to a fluctuation in the freshwater concentrations. The freshwater concentration is probably influenced by winter flows in the Santa Clara River. When the river is closed, this influence by the waste water is probably more dramatic, as the river flows are minimal or nonexistent. When this happens during spring and summer, there is a dominance of species that prefer fresh and brackish water habitats, thus, potentially contributing to the beneficial uses for these species.

Aquatic Community

The discharge provides a consistent source of freshwater input that likely would not be available otherwise. As the dry season progresses, one-hundred percent of the Santa Clara River surface waters are diverted upstream at the Vern Freeman Diversion. Flows downstream of the diversion are subsurface or minimal. Street run-off, agricultural inputs and golf course run-off likely contribute the majority of the river flow into the estuary. The consistent source of freshwater input supplied by the discharge provides a viable habitat for the tidewater goby reproduction and rearing and southern steelhead rearing. It also provides habitat for larger fish species that provide a food source for terns and other water fowl.

4.2 THE ESTUARY IS PRIMARILY A FRESHWATER ECOSYSTEM; HARDNESS-BASED LIMITS ARE PROPOSED

The aquatic fauna collected in the Estuary clearly indicate an estuarine ecosystem dominated by freshwater. Both the benthic infauna and the aquatic fish and invertebrates sampled in the three bioassessment surveys support this conclusion. These results are consistent with the preliminary conclusions of the two-year, bi-monthly surveys conducted in the DPR/USFWS study. This finding justifies hardness-based standards for the metals.

4.2.1 DATA INDICATING A FRESHWATER ECOSYSTEM

Because of their relative lack of mobility, the benthic infauna community is a widely used indicator of aquatic ecosystem health. Extensive marine monitoring of infaunal communities has been conducted around point sources, including the discharge outfalls of major wastewater treatment plants, and in ambient locations off the California Coast and in San Francisco Bay (SCCWRP, 1985-1998, SFEI, 1995-1998). Midge and other insect larvae, freshwater ostracods and freshwater oligochaetes are the predominant species of the infaunal community in the Estuary indicating a largely freshwater ecosystem.

The abundance of mildly estuarine to freshwater fish is another indicator of a freshwater aquatic community. Tidewater gobies, the most prevalent and abundant fish species collected in the Estuary, are found in shallow, marine areas and in the lower reaches of streams. They are known to spend large portions of their lifecycle in freshwater (Moyle, 1976). The other fish species collected with the tidewater gobies, the Mosquito fish, Green Sunfish, Arroyo Chub and Fathead minnows are all freshwater species. The California Kellifish is an estuarine species with a wide salinity range that is known to establish populations in freshwater streams. The presence of the two tadpole species also indicates a freshwater environment (Stebbins, 1985).

4.2.2 HARDNESS-BASED STANDARDS FOR METALS COCS

The proposed limits for the metals were set based upon protection of saltwater aquatic life. The California Toxics Rule specifies the following:

(1) The freshwater criteria apply at salinities of 1 part per thousand or below at locations where this occurs 95% or more of the time; (2) saltwater criteria apply at salinities of 10 parts per thousand and above at locations where this occurs 95% or more of the time; and (3) at salinities between 1 and 10 parts per thousand the more stringent of the two apply unless the EPA approves the application of the freshwater or saltwater criteria based on an appropriate bioassessment. (40 CFR 131 F 2)

Water quality measurements show that the salinity of the Estuary falls into category (3). The findings of the bioassessment indicate that the ecosystem is dominantly freshwater. Accordingly, the methods described in the California Toxics Rule, 40 CFR 131.38 (b) and (c) can be used to calculate hardness-based water quality objectives. Using a hardness

of 400 mg/l (low for the Estuary, but the highest allowed by the rule) and a water effect ratio of 1 (default; conservative) leads to the following limits for the metals:

Metal	NPDES Limit	Proposed NPDES Limit (based on 400 mg/l hardness)
Copper	2.9	29
Nickel	8.3	168
Lead	8.5	11
Zinc	86	381

The facility's discharge has continually met these proposed limits since January, 1997.

4.3 Proposed Limits for Organic COCs

This section describes the basis of the permit limits for the two organic COCs, describes the beneficial uses of the estuary, and proposes a basis for the permit limit to be in alignment with the beneficial uses. Based upon this analysis, higher limits for the two organic compounds appeared to be justified, while still being protective of the beneficial uses.f

4.3.1 Basis for Permit Limits

The limits for the two organic COCs, dichlorobromomethane and bis(2-ethylhexyl)phthalate were set based upon human health criteria. The permit limit for bis(2-ethylhexyl)phthalate was set at the 10^{-6} risk level for consumption of organisms given in the California Toxics Rule (5.9 µg/l). The permit limit for dichlorobromomethane was set at 22 µg/l, well below the 10^{-6} risk level for consumption of organisms given in the California Toxics Rule (46 µg/l).

The exposure pathway that EPA used in establishing these limits in the California Toxics Rule was the consumption of 6.5 grams per day of fish and shellfish contaminated at a level equal to the criteria concentration and multiplied by a bioconcentration factor (CTR 40 CFR 131 E 3). This consumption rate was equivalent to the average per-capita consumption rate of all freshwater and estuarine fish and shellfish for the population of the United States. EPA states that the use of this rate is also protective of subpopulations of subsistence anglers who consume more than the average, because even a ten times greater ingestion rate would result in a calculated risk of 10^{-5}, which EPA has historically considered to be adequately protective (CTR 40 CFR 131 E 3).

4.3.2 HUMAN EXPOSURE AND ESTUARY BENEFICIAL USES

Water Contact Recreation (REC-1) – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Although the campground had a number of campers, we did not observe any wading or swimming in the Estuary during our surveys. During the Summer survey when most swimming could be expected, the sandbar was breached and water levels were insufficient for swimming. Motorized water craft (e.g. water skiing, boating, personal watercraft) are prohibited in the 160 acre State Nature Preserve which includes the Estuary. It is our observation that the Estuary (and lagoon when the sandbar is not breached) is generally too shallow and turbid for SCUBA/skin diving.

Commercial and Sport Fishing (COMM) – Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

The Santa Clara Estuary Natural Preserve (California Administrative Code Title XIV Div. 3, Chapter 10, 4759), which entirely encompasses the area affected by the discharge, is subject to legal restrictions on these beneficial uses. Specifically, "[n]o person shall molest, hunt, disturb, injure, trap, take, net, poison, harm, or kill any kind of animal or fish, or so attempt, except that fish may be taken other than for commercial purposes in accordance with the state fishing laws and regulations." (California Administrative Code Title XIV Div. 3, Chapter 1, 4305). In addition, the California Department of Fish and Game has a moratorium on any type of fishing downstream of the Highway 23 bridge in Fillmore. Accordingly, although the Estuary has the COMM beneficial use, the level of such use is currently prohibited. In addition, during the 1999 surveys no fish or shellfish of edible size were encountered.

4.3.3 REEVALUATION OF PERMIT LIMIT BASED UPON LEVEL OF BENEFICIAL USES

Taken together, these observations and regulations suggest that the exposure scenario that forms the basis for the permit limit may be overly restrictive to protect the beneficial uses of the Estuary. In discussing potential changes to the Human Health Criteria Methodology presented in the California Toxics Rule, EPA included the following:

> *Default fish and shellfish consumption values are presented for the general population, for sportfishers, and for subsistence fishers, replacing the single value of 6.5 grams/day used in the 1980 guidance. States may use a fish and shellfish intake level derived from local data on fish and shellfish consumption in place of the default values provided. However, the fish and shellfish intake level chosen to must be protective of highly exposed individuals in the population. (40 CFR 131 E 3)*

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The prohibition of fishing and shellfish harvesting in the estuary suggests that a consumption rate of zero would be appropriate in the health exposure models. A value of one half of the EPA value would still be conservatively protective of the COMM beneficial use. Use of this consumption rate leads to allowable concentrations of 11.8 µg/l for bis(2-ethylhexyl)phthalate and 92 µg/l for dichlorobromomethane. These values would result in a 10^{-6} risk level. As in the California Toxics Rule, these values would also be protective of highly exposed individuals in the population, since a ten times higher consumption level would result in a 10^{-5} risk level, which EPA has historically considered to be adequately protective (CTR 40 CFR 131 E 3). The facility's discharge consistently meets these proposed limits.

4.4 THE CRITERIA FOR DETERMINING SITE-SPECIFIC OBJECTIVES ARE MET

The Basin Plan and CEBEP outline a series of criteria for determining site specific objectives. Although we are not proposing site-specific objectives, these criteria provide a conservative approach for ensuring the protection of the beneficial uses of the Estuary. Each of these criteria are addressed below:

- Assure that aquatic life and terrestrial predators are not currently threatened or impaired from bioaccumulation of these constituents of concern *and* that the biota will not be threatened or impaired by the proposed site-specific levels.

    - The survey was conducted while the Facility was operating under the interim limits. As no impairment was noted, the proposed levels will be protective. The bioassessment determined that the ecosystem is predominantly freshwater. Water hardness affects the biological availability of metals. Our calculations show that given the water hardness in the Estuary, the concentrations of metals in the discharge do not threaten or impair wildlife in the Estuary. Review of the EPA's ECOTOX database (which includes AQUIRE, PHYTOTOX, and TERRETOX) did not contain limits for tissue concentrations of the two organics of concern. An *in-situ* bioaccumulation study following the protocols of the California State Mussel Watch program is currently under way and will provide data on the levels of tissue bioaccumulation in freshwater clams.

- Assure that human consumers of fish and shellfish are currently protected from bioaccumulation of the constituents of concern and will not be affected from bioaccumulation of these pollutants under the proposed site-specific objectives.

    - Because the Estuary is a Natural Preserve, and state regulations prohibit fishing and shellfish harvesting in the Estuary, human consumption of the seafood in the Estuary is much lower than assumed in standard risk models. Alternate standards of human health risk used to calculate revised water quality objectives for the two organic constituents are protective of human health risk, while supporting all designated beneficial uses.

- Assure that aquatic life is and will be protected from chronic toxicity from the proposed site-specific objectives.

    - In compliance with the NPDES permit requirements, the City performs regular monitoring of the chronic and acute toxicity of the discharge. These tests consistently show no toxicity in the effluent at the existing discharge concentrations. Based upon the hardness of the discharge, the metals concentration limits proposed will be protective of chronic toxicity.

- Assure that the integrity of the aquatic ecosystem will be protected under the proposed site-specific objectives.

    - The bioassessment of the aquatic ecosystem and review of on-going studies demonstrate that the ecological community is healthy under five years of discharge under the interim discharge limits.

- Assure that no other beneficial uses will be threatened or impaired by the proposed site-specific objectives.

    - Review of the level of utilization of the beneficial uses demonstrates that the beneficial uses are supported by the discharge and well-used (within the statutory limits of the Nature Preserve) under five years of discharge under the interim discharge limits.

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